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Space Administration
Langley Research Center

Scientific and Technical
Information Program Office

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NASA STI Program ... in Profile

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Introduction

Scientific and Technical Aerospace Reports (STAR) is an online information resource listing citations and abstracts of NASA and world wide aerospace-related STI. Updated biweekly, *STAR* highlights the most recent additions to the NASA Aeronautics and Space Database. Through this resource, the NASA STI Program provides timely access to the most current aerospace-related Research & Development (R&D) results.

STAR subject coverage includes all aspects of aeronautics and space research and development, supporting basic and applied research, and application, as well as aerospace aspects of Earth resources, energy development, conservation, oceanography, environmental protection, urban transportation and other topics of high national priority. The listing is arranged first by 11 broad subject divisions, then within these divisions by 76 subject categories and includes two indexes: subject and author.

STAR includes citations to Research & Development (R&D) results reported in:

- NASA, NASA contractor, and NASA grantee reports
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- Translations
- NASA-owned patents and patent applications
- Other U.S. Government agency and foreign patents and patent applications
- Domestic and foreign dissertations and theses

The NASA STI Program

The NASA Scientific and Technical Information (STI) Program was established to support the objectives of NASA's missions and research to advance aeronautics and space science. By sharing information, the NASA STI Program ensures that the U.S. maintains its preeminence in aerospace-related industries and education, minimizes duplication of research, and increases research productivity.

Through the NASA Center for AeroSpace Information (CASI), the NASA STI Program acquires, processes, archives, announces and disseminates both NASA's internal STI and world-wide STI. The results of 20th and 21st century aeronautics and aerospace research and development, a worldwide investment totaling billions of dollars, have been captured, organized, and stored in the NASA Aeronautics and Space Database. New information is continually announced and made available as it is acquired, making this a dynamic and historical collection of value to business, industry, academia, federal institutions, and the general public.

The STI Program offers products and tools that allow efficient access to the wealth of information derived from global R&D efforts. In addition, customized services are available to help tailor this valuable resource to meet your specific needs.

For more information on the most up to date NASA STI, visit the STI Program's website at <http://www.sti.nasa.gov>.

NASA STI Availability Information

NASA Center for AeroSpace Information (CASI)

Through NASA CASI, the NASA STI Program offers many information products and services to the aerospace community and to the public, including access to a selection of full text of the NASA STI. Free registration with the program is available to NASA, U.S. Government agencies and contractors. To register, contact CASI at help@sti.nasa.gov. Others should visit the program at www.sti.nasa.gov. The 'search selected databases' button provides access to the NASA Technical Reports Server (TRS) – the publicly available contents of the NASA Aeronautics and Space Database.

Each citation in *STAR* indicates a 'Source of Availability'. When CASI is indicated, the user can order this information directly from CASI using the [STI Online Order Form](#) or contact help@sti.nasa.gov or telephone the CASI Help Desk at 301-621-0390. Before ordering you may access price code tables for STI [documents](#) and [videos](#). When information is not available from CASI, the source of the information is indicated when known.

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National Technical Information Service (NTIS)

The National Technical Information Service serves the American public as a central resource for unlimited, unclassified U.S. Government scientific, technical, engineering, and business related information. For more than 50 years NTIS has provided businesses, universities, and the public timely access to well over 2 million publications covering over 350 subject areas. Visit NTIS at <http://www.ntis.gov>.

The Federal Depository Library Program (FDLP)

The U.S. Congress established the **Federal Depository Library Program (FDLP)** to ensure access by the American public to U.S. Government information. The program acquires and disseminates information products from all three branches of the U.S. Government to nearly 1,300 Federal depository libraries nationwide. The libraries maintain these information products as part of their existing collections and are responsible for assuring that the public has free access to the information. Locate the Federal Depository Libraries http://www.access.gpo.gov/su_docs.

The U.S. Patent and Trademark Office (USPTO)

The U.S. Patent and Trademark Office provides online access to full text patents and patent applications. The database includes patents back to 1976 plus some pre-1975 patents. Visit the USPTO at <http://www.uspto.gov/patft/>.

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Indexes

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[Personal Author Index](#)

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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01

AERONAUTICS (GENERAL)

Includes general research topics related to manned and unmanned aircraft and the problems of flight within the Earth's atmosphere. Also includes manufacturing, maintenance, and repair of aircraft. For specific topics in aeronautics, see *categories 02 through 09*. For information related to space vehicles see *12 Astronautics*.

2003006234 NASA Glenn Research Center, Cleveland, OH, USA

Fan Noise Source Diagnostic Test: LDV Measured Flow Field Results

Podboy, Gary C.; Krupar, Martin J.; Hughes, Christopher E.; Woodward, Richard P.; July 2003; 33 pp.; In English; Eight Aeroacoustics Conference, 17-19 Jun. 2002, Breckenridge, CO, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS3-26617; NAS3-98004; WBS 22-781-30-08

Report No.(s): NASA/TM-2003-212330; E-13925; NAS 1.15:212330; AIAA Paper 2002-2431; No Copyright; Avail: CASI; A03, Hardcopy

Results are presented of an experiment conducted to investigate potential sources of noise in the flow developed by two 22-in. diameter turbofan models. The R4 and M5 rotors that were tested were designed to operate at nominal take-off speeds of 12,657 and 14,064 RPMC, respectively. Both fans were tested with a common set of swept stators installed downstream of the rotors. Detailed measurements of the flows generated by the two were made using a laser Doppler velocimeter system. The wake flows generated by the two rotors are illustrated through a series of contour plots. These show that the two wake flows are quite different, especially in the tip region. These data are used to explain some of the differences in the rotor/stator interaction noise generated by the two fan stages. In addition to these wake data, measurements were also made in the R4 rotor blade passages. These results illustrate the tip flow development within the blade passages, its migration downstream, and (at high rotor speeds) its merging with the blade wake of the adjacent (following) blade. Data also depict the variation of this tip flow with tip clearance. Data obtained within the rotor blade passages at high rotational speeds illustrate the variation of the mean shock position across the different blade passages.

Author

Laser Doppler Velocimeters; Aerodynamic Noise; Rotor Aerodynamics; Stators; Noise Generators; Interactional Aerodynamics

2003006888 NASA Langley Research Center, Hampton, VA, USA

Aeroelastic Stability of a Four-Bladed Semi-Articulated Soft-Inplane Tiltrotor Model

Nixon, Mark W.; Langston, Chester W.; Singleton, Jeffrey D.; Piatak, David J.; Kvaternik, Raymond G.; Corso, Lawrence M.; Brown, Ross; [2003]; 9 pp.; In English; AHS 59th Annual Forum and Technology Display, 6-8 May 2003, Phoenix, AZ, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

A new four-bladed, semi-articulated, soft-inplane rotor system, designed as a candidate for future heavy-lift rotorcraft, was tested at model scale on the Wing and Rotor Aeroelastic Testing System (WRATS), a 1/5-size aeroelastic wind-tunnel model based on the V-22. The experimental investigation included a hover test with the model in helicopter mode subject to ground resonance conditions, and a forward flight test with the model in airplane mode subject to whirl-flutter conditions. An active control system designed to augment system damping was also tested as part of this investigation. Results of this study indicate that the new four-bladed, soft-inplane rotor system in hover has adequate damping characteristics and is stable throughout its rotor-speed envelope. However, in airplane mode it produces very low damping in the key wing beam-bending mode, and has a low whirl-flutter stability boundary with respect to airspeed. The active control system was successful in augmenting the damping of the fundamental system modes, and was found to be robust with respect to changes in rotor-speed and airspeed. Finally, conversion-mode dynamic loads were measured on the rotor and these were found to be significantly

lower for the new soft-inplane hub than for the previous baseline stiff-inplane hub.

Author

Tilt Rotor Aircraft; Rotor Aerodynamics; Scale Models; Wind Tunnel Models; Wind Tunnel Tests; Aeroelasticity; X Wing Rotors

20030067458 Technische Univ., Delft

Literature Survey on Aeromechanical Instabilities for Helicopters and Wind Turbines

Pavel, M. D.; Schoones, M. M. J.; Jul. 1999; 72 pp.; In English

Report No.(s): PB2003-104364; M-877; ST-LR-1001; Copyright; Avail: National Technical Information Service (NTIS)

This report describes the aeroelastic and aeromechanical dynamic instabilities encountered during design and development of helicopters and horizontal axis wind turbines. By definition, a dynamic instability is a self-excited vibration in which the amplitude of the motion becomes larger and larger with time and which (1) can stabilize to a higher level of vibration (limit cycle) or, (2) can go to the point of structure failure. The report is divided in two main parts, a first section which deals with problems related to helicopters and a second section which deals with the specific aeroelastic problems which are met in horizontal axis wind turbine configurations. According to the subsystems participating in the instability, dynamic instabilities are classified in two classes: (1) Dynamic Instabilities of the Rotor; (2) Dynamic Instabilities of the Rotor/Airframe for Helicopters or Rotor/Tower for the Wind Turbines. The rotor instabilities involve only the blade degrees of freedom such as flapping, lagging and torsion. In the rotor/body instabilities, the blade degrees of freedom couple to the body degrees of freedom.

NTIS

Helicopters; Wind Turbines; Vibration

20030067462 Technische Univ., Delft, Netherlands, Technische Hogeschool, Delft, Netherlands

Thrust-Vectored Windshear Recovery

Visser, H. G.; Jun. 1998; 40 pp.; In English

Report No.(s): PB2003-104365; M-845; Copyright; Avail: National Technical Information Service (NTIS)

This study presents a preliminary evaluation of the application of Thrust Vector Flight Control (TVFC) technology for improving windshear recovery of civil aircraft in a microburst encounter on final approach. A numerical trajectory optimization technique based on the method of multiple shooting is applied to achieve a microburst escape with minimal loss of altitude for a Boeing 727 type aircraft. Although the application of TVFC does result in a slight improvement in recovery altitude, there is also a price to pay in the sense that TVFC utilization significantly hampers the ability to gain specific energy during recovery. Maintaining an energy buffer during a microburst encounter is highly desirable to achieve robustness with respect to uncertainties in windshear size and strength. TVFC aided windshear recovery has been compared with an alternative approach to improve the windshear survivability capability, namely the application of lateral maneuvering.

NTIS

Evaluation; Flight Control; Thrust Vector Control; Wind Shear

20030067635 Swedish Defence Research Establishment, Stockholm, Sweden

FOI's Research on Air Vehicles (FoT 25)

Gustafsson, A.; Hovmark, G.; Jun. 2002; In Swedish

Report No.(s): PB2003-104337; FOI-R-0525-SE; No Copyright; Avail: National Technical Information Service (NTIS)

This report summarizes work performed at FOI during the period April 2001 - February 2002 under contract from FMV with contract number FMV 75120-LB133879 och FMV-225820-LB567198.

NTIS

Research Vehicles; Aeronautical Engineering; Computational Fluid Dynamics; Technology Assessment; Aerodynamics

02 AERODYNAMICS

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans, and other elements of turbomachinery. For related information see also *34 Fluid Mechanics and Thermodynamics*.

20030066981 National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, CA, USA
Lift, Drag, and Pitching Moment of Low-Aspect-Ratio Wings at Subsonic and Supersonic Speeds: Triangular Wing of Aspect Ratio 2 with NACA 0005-63 Thickness Distribution, Cambered and Twisted for a Trapezoidal Span Load Distribution

Smith, Willard G.; Phelps, E. Ray; February 5, 1951; 21 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-A50K27a; No Copyright; Avail: CASI; [A03](#), Hardcopy

A wing-body combination having a plane triangular wing of aspect ratio 2 with NACA 0005-63 thickness distribution in streamwise planes, and twisted and cambered for a trapezoidal span load distribution has been investigated at both subsonic and supersonic Mach numbers. The lift, drag, and pitching moment of the model are presented for Mach numbers from 0.60 to 0.90 and 1.30 to 1.70 at a Reynolds number of 3.0 million. The variations of the characteristics with Reynolds number are also shown for several Mach numbers.

Author

Body-Wing Configurations; Aerodynamic Characteristics; Wind Tunnel Tests; Aerodynamic Loads; Axial Loads; Wind Tunnels; Pitching Moments; Low Aspect Ratio Wings; Supersonic Speed; Subsonic Speed

20030067330 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Aerodynamic Characteristics of Bodies at Supersonic Speeds: A Collection of Three Papers

November 09, 1951; 46 pp.; In English; See also 20030067331 - 20030067333

Report No.(s): NACA-RM-A51J25; No Copyright; Avail: CASI; [A03](#), Hardcopy

The three papers collected here are: 'The Effect of Nose Shape on the Drag of Bodies of Revolution at Zero Angle of Attack.', 'Base Pressure on Wings and Bodies with Turbulent Boundary Layers', and 'Flow over Inclined Bodies'. The subject of the first paper is the drag of the nose section of bodies of revolution at zero angle of attack. The main object of the second paper is to summarize the principal results of the many wind tunnel and free flight measurements of base pressure on both bodies of revolution and blunt trailing edge airfoils.

CASI

Aerodynamic Characteristics; Aerodynamics; Wind Tunnel Tests; Supersonic Speed

20030067331 National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, CA, USA
The Effect of Nose Shape on the Drag of Bodies of Revolution at Zero Angle of Attack

Seiff, Alvin; Sandahl, Carl A.; Aerodynamic Characteristics of Bodies at Supersonic Speeds: A Collection of Three Papers; November 09, 1951, pp. 1-12; In English; NACA Conference on Aerodynamic Design Problems of Supersonic Guided Missiles, 2-3 Oct. 1951, Moffett Field, CA, USA; See also 20030067330; No Copyright; Avail: CASI; [A03](#), Hardcopy

The subject of this paper is the drag of the nose section of bodies of revolution at zero angle of attack. The magnitude of the nose drag in relation to the total drag is very distinctly a function of the body design and the Mach number. It can range from a very small fraction of the total drag of the order of 10 percent to a very large fraction as high as 80 percent. The natural objective of nose design is to minimize the drag, but this objective is not always the primary one. Sometimes other factors overshadow the desire for minimum drag. The most conspicuous example of this is the proposal of guidance engineers that large-diameter spheres and other very blunt shapes be used at the nose tip. This paper will attempt to discuss both phases of the problem, noses for minimum drag and noses with very blunt tips. The state of the theory will also be reviewed and recent theoretical developments described, since the theory still remains a very valuable tool for assaying the effects of compromises in design and departure from shapes for which experimental data are available.

Author

Noses (Forebodies); Aerodynamic Drag; Bodies Of Revolution; Zero Angle Of Attack

20030067332 National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, CA, USA
Base Pressure on Wings and Bodies with Turbulent Boundary Layers

Chapman, Dean R.; Aerodynamic Characteristics of Bodies at Supersonic Speeds: A Collection of Three Papers; November 09, 1951, pp. 13-30; In English; NACA Conference on Aerodynamic Design Problems of Supersonic Guided Missiles, 2-3

Oct. 1951, Moffett Field, CA, USA; See also 20030067330; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

At present there is no satisfactory theory for calculating the pressure which acts at the blunt base of an object traveling at supersonic velocity. In fact, the essential mechanism determining the base pressure is only imperfectly understood. As a result, the existing knowledge of base pressure is based almost entirely on experiments. The main object of this paper is to summarize the principal results of the many wind tunnel and free flight measurements of base pressure on both bodies of revolution and blunt trailing edge airfoils. A relatively simple method of estimating base pressure is presented, and an indication is given as to how the characteristics of base pressure play an essential role in determining the shape of an aerodynamically efficient object for supersonic flight.

Author

Base Pressure; Bodies Of Revolution; Blunt Trailing Edges; Wind Tunnel Tests; Airfoils

20030067375 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA

Cones in Supersonic Flow

Hantzsche, W.; Wendt, H.; Jahrbuch 1942 der deutschen Luftfahrtforschung; August 1947, pp. 80-190; In English; Original contains black and white illustrations

Report No.(s): NACA-TM-1157; No Copyright; Avail: CASI; A03, Hardcopy

In the case of cones in axially symmetric flow of supersonic velocity, adiabatic compression takes place between shock wave and surface of the cone. Interpolation curves between shock polars and the surface are therefore necessary for the complete understanding of this type of flow. They are given in the present report by graphical-numerical integration of the differential equation for all cone angles and airspeeds.

Author

Mach Cones; Supersonic Flow; Axisymmetric Flow; Adiabatic Conditions

20030067524 Florida Univ., Gainesville, FL

Computational Aeroelasticity Using a Pressure-Based Solver

Shyy, Wei; Kamakoti, Ramji; Lian, Yongsheng; Regisford, Sean; Kurdila, Andrew; Feb. 28, 2003; 15 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0006

Report No.(s): AD-A414332; AFRL-SR-AR-TR-03-0191; No Copyright; Avail: CASI; A03, Hardcopy

The fluid-structure interaction problem is studied for two different wing configurations based on moving grid techniques. These configurations demonstrate the interaction between a rigid structure and fluid, as well as the interaction between a flexible structure and fluid. A loosely coupled approach is used to perform the combined fluid and structure computations. The flow solver is based on an unsteady, implicit, three-dimensional, multi-block, pressure -based Navier-Stokes solver. The rigid structural model is based on a linear, time-invariant model derived via classical structural finite elements whereas the flexible structural model is based on a non-linear dynamic membrane model with the material obeying the hyperelastic Mooney's model. A suitable interfacing technique is incorporated to couple and synchronize the flow and structure solver. We present unsteady computations performed on a 45 degrees wing with sweep back as well as a membrane wing typically motivated by micro-air vehicle applications.

DTIC

Computational Fluid Dynamics; Aeroelasticity; Aerodynamic Configurations

20030067620 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA

Drag Corrections in High-Speed Wind Tunnels

Ludwig, H.; Zentrale fuer Wissenschaftliches Berichtswesen der Luftfahrtforschung des Generalluftzeugmeisters(ZWB) Berlin-Adershof; July 1947; 35 pp.; In English

Report No.(s): NACA-TM-1163; No Copyright; Avail: CASI; A03, Hardcopy

In the vicinity of a body in a wind tunnel the displacement effect of the wake, due to the finite dimensions of the stream, produces a pressure gradient which evokes a change of drag. In incompressible flow this change of drag is so small, in general, that one does not have to take it into account in wind-tunnel measurements; however, in compressible flow it becomes considerably larger, so that a correction factor is necessary for measured values. Correction factors for a closed tunnel and an open jet with circular cross sections are calculated and compared with the drag - corrections already known for high-speed tunnels.

Author

Supersonic Wind Tunnels; Aerodynamic Drag; Mathematical Models; Wind Tunnel Tests

AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; airport ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in *09 Research and Support Facilities (Air)*. Air traffic control is covered in *04 Aircraft Communications and Navigation*. For related information see also *16 Space Transportation and Safety* and *85 Technology Utilization and Surface Transportation*.

20030066260 General Accounting Office, Washington, DC

National Airspace System: Current Efforts and Proposed Changes to Improve Performance of FAA's Air Traffic Control System

May 2003; 34 pp.; In English

Report No.(s): PB2003-105904; GAO-03-542; No Copyright; Avail: CASI; [A03](#), Hardcopy

To accelerate the modernization and improve the performance of the air traffic control system, the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (AIR-21) created the Air Traffic Services Subcommittee (subcommittee) to oversee the air traffic control system and help the Federal Aviation Administration (FAA) address long-standing weaknesses in its modernization program. The subcommittee is part of an aviation advisory council and consists of five private sector members with business expertise. AIR-21 gave the subcommittee the authority to approve strategic plans, budgets, and procurements over \$100 million. In addition, AIR-21 required FAA to hire a chief operating officer to manage the system's day-to-day operations. AIR-21 mandated that GAO report on the success of the subcommittee in improving the performance of the air traffic control system. Accordingly, as agreed with the congressional committees' offices, GAO reviewed the (1) actions taken by the subcommittee to carry out its oversight responsibilities and the obstacles that it encountered in doing so and (2) changes to the subcommittee's organization and oversight responsibilities that have been proposed to improve the performance of the air traffic control system.

NTIS

Air Traffic Control; Management; Airspace; Congressional Reports

20030066377 Nebraska Univ., Omaha, NE, USA

The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 2

Lee, Yeong-Heok, Editor; Bowen, Brent D., Editor; Tarry, Scott E., Editor; July 2001; 235 pp.; In English; Air Transport Research Society 5th International Conference on Air Transportation Operations and Policy, 19-21 Jul. 2001, Jeju Island, Korea, Republic of; See also 20030066378 - 20030066391

Report No.(s): UNOAI-01-7-Vol-2; Copyright; Avail: CASI; [A11](#), Hardcopy

The ATRS held its 5th Annual conference at the City University of Hong Kong Campus in July 2001. The conference was a success with nearly 140 participants including 70 presenters. Titles that comprise Volume 2 include: Intelligent Airport Gate Assignment System; A Study on the Effects of the Personality Compatibility to the Job Performance; ITS/CVO Application for Air cargo Transportation in Korea; An Airport as a Logistics and Economic Hub: The Case of Incheon International Airport; The Impact Of Aviation Safety over the Consumer's Behavior; The Integration of China and Taiwan Air Networks for Direct Air Cargo Services; Quality perception and carrier choice in Civil Aviation; Future Trends in Business Travel Decision Making; Cooperation Among German Airports in Europe; Inbound and Outbound Air Passenger Traffic Forecasting between the USA and Selected Asian countries; An Evaluation of Alternative Facilities for Airport Redevelopment using Fuzzy Linguistic Approach; Economic Analysis of Airline Alliances; The Aviation Cooperation between the two Koreas Preparing for the Reunification of the Peninsula; and A Study on the Air Transport Cooperation in Northeast Asia between China, Japan and Korea.

CASI

Air Transportation; Airline Operations; Civil Aviation

20030066378 Hankuk Aviation Univ., Kyunggido, Korea, Republic of

A Study on the Effects of the Personality Compatibility to the Job Performance

Kim, Chil-Young; Park, Kichan; Jeong, Jae-Hoon; Yoo, Kwang Eui; The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 2; July 2001; 16 pp.; In English; See also 20030066377; Copyright; Avail: CASI; [A03](#), Hardcopy

This paper presents the results of studies on the effect of the personality compatibility to the job performance. As an empirical study, the relevant data is gathered by questionnaire survey whose samples are collected from aircraft cockpit crews of Korean Air and Asiana Airlines. For the personality type classification, this study utilizes the Enneagram Theory. This

research claims that there are some personality types popular among Korean pilots, and that the desirable combination of personality in a cockpit crew team leads to better job performance, team satisfaction and minimization of human error. Consequently, this paper suggests that the personality compatibility should be considered when a cockpit crew team is organized. The results of this study may contribute to the improvement of the safety level concerned with flight operation.

Author

Flight Crews; Human Performance; Personality; Pilots (Personnel)

20030066379 Hanseo Univ., Chungnam, Korea, Republic of

The Impact of Aviation Safety over the Consumer's Behavior

Lee, Kang-Seok; Hong, Soon-Kil; Lee, Seung Chang; The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 2; July 2001; 14 pp.; In English; See also 20030066377; Copyright; Avail: CASI; [A03](#), Hardcopy

The research purpose for The Impact of Aviation Safety over the Consumer's Behavior lies at the judgement that airline consumers' selection criteria has much changed after several serious aviation accidents as before when we used to overlook 'aviation safety' variable through surveying to Korean aviation consumers and foreigners visit or travel Korea on various purposes. Therefore, for this research, practical analysis methods are employed after surveying to actual passengers who use Kimpo International Airport's international and domestic terminals. This study will be regarded significant in terms that empirical analysis was used to prove 'Aviation Safety', a variable which had not been regarded as a airline choice factor within Korea air transport market so far, and has an effect on the aviation consumers' airline preference change and choice after recent frequent aviation accidents. Presenting this dissertation, I wish, it can be another opportunity for Korean two national flag airlines to reappraise and reinforce the significance of 'aviation safety' and set forth immediate vigorous efforts to support the government's aviation safety improvement countermeasures. I hope the study to contribute and provide a variable idea and direction to improve aviation safety management of two Korean national flag carriers.

Author

Aircraft Safety; Civil Aviation; Consumers; Airports; Air Transportation

20030066380 Cranfield Univ., Bedford, UK

Future Trends in Business Travel Decision Making

Mason, Keith J.; The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 2; July 2001; 20 pp.; In English; 5th Air Transport Research Group Conference, 19-22 Jul. 2001, Cheju Island, Korea, Republic of; See also 20030066377; Copyright; Avail: CASI; [A03](#), Hardcopy

The business travel market has seen a marked change throughout the 1990s. The introduction of competitive pressures in the marketplace due to the liberalization of many markets has lead airlines to attempt to increase market share and network coverage, while trying to reduce their costs. At the same time companies have been increasingly recognizing the importance of travel expenditure to their businesses and making efforts to reduce this cost element within their businesses. These two major pressures has meant that the business travel market is in change and this paper reports the finding of a study to identify future trends in business travel decision making within the UK. The focus of the paper is on larger companies and comparison has been drawn with the trends in business travellers that work for small and medium sized companies.

Derived from text

Civil Aviation; Commerce; Decision Making; Economy; Air Transportation; Commercial Aircraft

20030066381 Vrije Univ., Amsterdam, Netherlands

Economic Analysis of Airline Alliances

Pels, Eric; The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 2; July 2001; 19 pp.; In English; See also 20030066377; Copyright; Avail: CASI; [A03](#), Hardcopy

A recent trend in aviation markets is the emergence of airline alliances. One could argue that at the national level the emergence of alliances is a continuation of the process of concentration and consolidation that was first characterized by the emergence of hub-and-spoke networks. The international aviation market is still subject to regulation, and airlines can only include foreign destinations into their networks by entering alliance agreements with foreign airlines. In this paper we find that full liberalization of specific international markets by means of a bi-lateral agreement results in higher welfare than the formation of an alliance. Carriers, however, will also in fully deregulated aviation markets most likely opt for an alliance.

Author

Airline Operations; Civil Aviation; Economic Analysis; Market Research

20030066383 Hanyang Univ., Ansan, Korea, Republic of

ITS/CVO Application for Air Cargo Transportation in Korea

Kim, Gun-Young; Kim, Woong-Yi; Kang, Kyung-Woo; The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 2; July 2001; 15 pp.; In English; See also 20030066377; Copyright; Avail: CASI; [A03](#), Hardcopy

Recently, many counties issued Commerical Vehicle Operations (CVO) systems, which are appropriate for their inherent transportation environment. It set out the architecture design not just transport system but also standard with ISO guide. The key factor is how much satisfied with international standard level. The standards development identifies potential standards areas, reviews existing standards efforts, describes a general process to assist standards development, and suggests beneficial actions to support and encourage CVO deployment. This study review CVO architecture method and looks at the design policy to meet ISO standard and also is intended for use as a guide to using the architecture standard in Korea. It is directed toward standards development organisations, product developers, service providers, and public agencies at all levels.

Author

Air Cargo; Air Transportation; Commercial Aircraft; Korea; Systems Engineering; Artificial Intelligence; Logistics

20030066384 Hankuk Aviation Univ., Kyunggido, Korea, Republic of

An Airport as a Logistics and Economic Hub: The Case of Incheon International Airport

Lee, Hunsoo; Yang, Han Mo; The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 2; July 2001; 17 pp.; In English; See also 20030066377; Copyright; Avail: CASI; [A03](#), Hardcopy

The opening of Incheon International Airport (IIA) provides excellent opportunities for aviation industries in Korea. Also, it is essential to develop effective mechanisms that can be used to revitalize aerospace-related and strategically important industries, and national economy through growth of IIA toward the logistics hub in Northeast Asia. This research attempts to derive strategies to develop The Winged City (TWC) which covers IIA and its vicinity into the airfreight transportation hub, total logistics hub, distribution hub and economic hub incrementally. Air transportation policies to support development of IIA into a logistics hub include: adopting Open Sky policy; effective responses to changes in air transportation policies of other countries; strategic alliances; creation of sufficient O/D and transshipment freight; minimization of rates and related logistics costs; accurate forecasting and continuous investments; real-time interface with Kimpo airport; aggressive marketing strategies; and improvements in competitiveness of Korean flag carriers. Although strategies for IIA as a logistics hub may include various aforementioned options in extensive areas, this research places greater emphasis on mixed-use development strategies for TWC as an economic hub. Development strategies of Asian Hub that provides a basic framework of the logistics hub in Northeast Asia and Asian Business Center and Asian Logistics Center that are core projects of mixed-use development plans of TWC are suggested.

Derived from text

Airports; Logistics; Korea; Air Transportation; Economics; Civil Aviation

20030066385 National Cheng Kung Univ., Tainan, Taiwan, Province of China

The Integration of China and Taiwan Air Networks for Direct Air Cargo Services

Lin, Cheng-Chang; Chen, Yin-Chieh; The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 2; July 2001; 15 pp.; In English; See also 20030066377

Contract(s)/Grant(s): NSC-89-2211-E006-142; Copyright; Avail: CASI; [A03](#), Hardcopy

Two sides of Taiwan Strait speak the same language and share the same culture, however, the economic and social environments are quite different. China is a developing country with a vast of cheap labors and plenty of raw materials. Contrarily, Taiwan is a developed country with high-technology manufacturing economic base. Integrally, two sides perform mutually dependent but complementary activities on the global supply-chain manufacturing. As a result, the trade between two sides grew in double-digits annually in the 90's. Even though there are no direct air links between two sides due to the political differences, the direct air links are inevitable. In this research, we researched and interviewed through a vast of governmental documents of China, Taiwan, Hong Kong and Macau, and air cargo carriers and airlines serving China-Taiwan air links. These materials enable us to tabulate the trade, estimate the air cargo and realize the major carriers and airports serving the China-Taiwan air link. Subsequently, we analyzed the current Chinese air route maps of her domestic airlines, and used the connectivity measurement to classify airports into national, regional and local classes. The classification allows us to determine the China hub-and-spoke air network and potential airports for future direct air connections. With the development of a mathematical model, we determined the top direct airfreight airports were Shanghai Xiamen and Changsha. The outcome

does not coincide with direct passenger airports. The top three most proposed by researchers are Fuzhou, Xiamen and Shanghai.

Author

Air Cargo; China; Taiwan; Airports; Air Transportation

20030066386 Centraal Planbureau, The Hague, Netherlands

Quality Perception and Carrier Choice in Civil Aviation

Lijesen, Mark G.; The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 2; July 2001; 17 pp.; In English; See also 20030066377; Copyright; Avail: CASI; [A03](#), Hardcopy

The recent emergence of low cost carriers has drawn considerable attention in civil aviation. Many travelers nowadays choose no frill flights at a low fare, which suggests that carriers have in the past allocated too much of their resources to quality. In this paper, we turn our attention to the quality of civil aviation service. We define quality as all factors other than price, that influence consumers choices for carriers. We develop a framework where carrier choice is determined by generalized travel costs and the quality image of carriers. The latter may be either experienced or perceived quality of a carrier. The valuation of travel costs and quality image is influenced by person and trip characteristics, as well as by past experiences. We use our framework to survey four types of approaches to quality in civil aviation. First of all, we analyze travel demand studies, both relating to demand volumes and carrier or airport choice. A second type consists of studies focussed on a single quality indicator. Next, we examine the results of carrier performance evaluation, while the fourth type consists of market research studies. We find that travel demand studies are mainly concerned with generalized costs. Performance evaluations are more likely to yield a complete image of carrier quality.

Author

Civil Aviation; Air Transportation; Airports; Market Research

20030066387 Ministry of Construction and Transportation, Korea, Republic of

The Aviation Cooperation Between the Two Koreas Preparing for the Reunification of the Peninsula

Shin, Dong Chun; The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 2; July 2001; 14 pp.; In English; See also 20030066377; Copyright; Avail: CASI; [A03](#), Hardcopy

In the civil aviation field, there have been intermittent and indirect dialogues between the two Koreas through International Civil Aviation Organization (ICAO) intermediary role over the past couple of decades, mainly regarding the establishment of Air Traffic Services (ATS) routes passing through FIRs of the respective country. The continued stubbornness of Democratic People's Republic of Korea (DPRK) to avoid any direct contact with Republic of Korea (ROK) has prevented the two Koreas from achieving any meaningful agreement between them in this area. Since the Summit Meeting between the two Koreas in June 2000, where some special charter flights were allowed to transport President Kim and his entourage, there have been quite a number of charter flights through an informal Yellow Sea airway carrying delegations of one of the two Koreas, mainly comprising dispersed family members for reunion events and members and troupe for some cultural exchange programs. The first case of mutual cooperation is regarding the establishment of direct ATS route between Tokyo and Beijing which had been pursued since the late 1970s. Several players have been involved in this matter from the beginning, including the four States (i.e. ROK, DPRK, Japan and China), IATA (International Air Transport Association) representing the interests of the carriers who would like to use a shortcut between Tokyo and Beijing, and ICAO, responsible for coordinating the positions of the four States concerned. In the end, ICAO's initiative ended up not being realized due to ICAO's lack of understanding of the peninsula's political situation. As a result of the conclusion of the bilateral air services agreement, Korea and China established a direct route between Seoul and Beijing, not relying upon any outside parties. The second case is regarding the establishment of a direct ATS route passing through Pyongyang and Taegu FIRs. The aeronautical authorities of ROK maintained the two principles regarding this matter: First, the safety of flight shall be guaranteed by all means and cannot be compromised by other factors. Second, operation on ATS route within and/or through FIRs shall be allowed to all civil aircraft of all States on the basis of the principle of non-discrimination. Therefore the establishment of a direct airway through the FIRs of the two Koreas was up to the determination of North Korean authorities. It seemed that considering that FIR is not airspace at all and the allowance of some flights to fly through its FIR would bring great economic benefits to a North Korean standard, the authorities finally agreed with its South Korean counterpart on the procedure on ATS cooperation. An inaugural flight was made on 23 April 1998 passing through transfer point of air traffic control between the Taegu and Pyongyang ACCs of the two Koreas. In order to facilitate the aviation cooperation between the Koreas, the number of charter flights by airlines of either Korea should be increased so as to develop into scheduled flights, hopefully in the near future. Normally an air services agreement is needed in order for either party to allow a carrier or carriers of the other party to commence scheduled services. Before both Koreas could have a full-scale cooperation such as having scheduled services,

there could be many ways and means to encourage cooperation in the civil aviation field. For example, the two governments can allow people, from government or the private sector, involved in civil aviation to meet each other, on such occasions as seminars, workshops and informal meetings. Airlines can reach commercial agreements before formal consultations between the governments take place.

Author

Civil Aviation; Korea; Peninsulas; Air Transportation

20030066390 North Dakota State Univ., Fargo, ND, USA

Inbound and Outbound Air Passenger Traffic Forecasting between the USA and Selected Asian Countries

Park, Joon Je; Koo, Won W.; The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 2; July 2001; 15 pp.; In English; See also 20030066377; Copyright; Avail: CASI; [A03](#), Hardcopy

The air passenger traffic volume has increased between the USA and Asian countries for the last 15 years. This article discusses and analyzes international air passenger traffic between the USA and selected Asian countries (Japan, S. Korea, Taiwan, China, and Hong Kong). A pooling technique is used to forecast air passenger traffic for short- and medium-terms. Major explanatory variables include income per capita, airfare, trade volume, and exchange rate. Effects of income and Asian financial crisis on the air passenger traffic volume are evaluated.

Author

Air Traffic; Asia; United States; Passengers; Demand (Economics)

20030066391 Korea Transport Inst., Seoul, Korea, Republic of

An Evaluation of Alternative Facilities for Airport Redevelopment Using Fuzzy Linguistic Approach

Park, Yonghwa; Kim, Byung Jong; The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 2; July 2001; 14 pp.; In English; See also 20030066377; Copyright; Avail: CASI; [A03](#), Hardcopy

Over the last few years, the major airports in Asia have been operating at or close to their capacity. As a result, Korea, Japan, China, Hong Kong, Thailand, Malaysia, and Indonesia took the decision to expedite the development of new airports. According to these new development airports, some of the existing airports have been completely closed to convert other functions and purposes and the others operated as a domestic airport. In the latter case, some idle facilities are needed for the redevelopment plans. This paper presents an evaluation of the alternative options for redevelopment of airport idle facilities in case of Seoul Gimpo International Airport. The methodology proposed in this paper can provide a practical and applicable evaluation of airport redevelopment plan. In particular, it can convert the perceptual views of differential interest groups, airport experts, passengers and airport peripheral community to the selection of alternative facilities. The direct interviewing method was conducted and taken related information in order to obtain the differential groups view. To evaluate and select the best option of the airport redevelopment, it has adopted a fuzzy linguistic approach and is based on airport experts, passengers, and peripheral community's points of view.

Author

Airports; Linguistics; Air Transportation; Fuzzy Sets

20030066956 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA

A Framework for Prognostics Reasoning

Clutz, Thomas C.; Dec. 2002; 287 pp.; In English

Report No.(s): AD-A413854; AFIT/DS/ENS/03-01; No Copyright; Avail: CASI; [A13](#), Hardcopy

The use of system data to make predictions about the future system state commonly known as prognostics is a rapidly developing field. Prognostics seeks to build on current diagnostic equipment capabilities for its predictive capability. Many military systems including the Joint Strike Fighter (JSF) are planning to include on-board prognostics systems to enhance system supportability and affordability. Current research efforts supporting these developments tend to focus on developing a prognostic tool for one specific system component. This dissertation research presents a comprehensive literature review of these developing research efforts. It also develops presents a mathematical model for the optimum allocation of prognostics sensors and their associated classifiers on a given system and all of its components. The model assumptions about system criticality are consistent with current industrial philosophies. This research also develops methodologies for combine sensor classifiers to allow for the selection of the best sensor ensemble.

DTIC

Prediction Analysis Techniques; Examination; Surveys; Automatic Test Equipment

20030066995 NASA Dryden Flight Research Center, Edwards, CA, USA

Even Minor Volcanic Ash Encounters Can Cause Major Damage to Aircraft

Grindle, Thomas J.; Burcham, Frank W., Jr.; ICAO Journal; March 2002; Volume 57, No. 2, pp. 12-14; In English; Original contains color illustrations

Contract(s)/Grant(s): WU 436-14-01-E8-YY

Report No.(s): H-2472; Copyright; Avail: Other Sources

In February 2000 the NASA DC-8 airborne sciences research airplane during a flight from Edwards Air Force Base to Kiruna Sweden, inadvertently flew through a diffuse volcanic ash cloud of the Hekla Volcano. Although there was no visible indication to the flight crew, sensitive research experiments and instruments detected the ash plume. In-flight performance checks and post-flight visual inspections revealed no damage to the airplane or engine 1st stage fan blades, but later detailed examination of the engines revealed clogged turbine cooling air passages. As a result, the engines were removed and overhauled at a cost of \$3.2M. This paper presents analysis of the volcanic ash plume, trajectory, analysis of the ash particles collected in aircraft filters and removed from the engines, and engine conditions.

Author

Dc 8 Aircraft; Research Aircraft; Volcanic Eruptions; Plumes; Ashes; Damage; Aircraft Engines; Jet Engines

20030067336 NASA Dryden Flight Research Center, Edwards, CA, USA

Advanced Range Safety System for High Energy Vehicles

Claxton, Jeffrey S.; Linton, Donald F.; September 2002; 9 pp.; In English; Eleventh International Conference on Space Planes and Hypersonic Systems and Technologies, 29 Sep. - 4 Oct. 2002, Orleans, France; Original contains black and white illustrations

Contract(s)/Grant(s): WU 710-35-74-00-FF-00-RSL

Report No.(s): H-2508; No Copyright; Avail: CASI; [A02](#), Hardcopy

The advanced range safety system project is a collaboration between the National Aeronautics and Space Administration and the USA Air Force to develop systems that would reduce costs and schedule for safety approval for new classes of unmanned high-energy vehicles. The mission-planning feature for this system would yield flight profiles that satisfy the mission requirements for the user while providing an increased quality of risk assessment, enhancing public safety. By improving the speed and accuracy of predicting risks to the public, mission planners would be able to expand flight envelopes significantly. Once in place, this system is expected to offer the flexibility of handling real-time risk management for the high-energy capabilities of hypersonic vehicles including autonomous return-from-orbit vehicles and extended flight profiles over land. Users of this system would include mission planners of Space Launch Initiative vehicles, space planes, and other high-energy vehicles. The real-time features of the system could make extended flight of a malfunctioning vehicle possible, in lieu of an immediate terminate decision. With this improved capability, the user would have more time for anomaly resolution and potential recovery of a malfunctioning vehicle.

Author

Hypersonic Vehicles; Launch Vehicles; Mission Planning; Range Safety; Aerospace Planes

20030067365 Federal Aviation Administration, Washington, DC

Criminal Acts Against Civil Aviation

2003; In English

Report No.(s): PB2003-105956; No Copyright; Avail: National Technical Information Service (NTIS)

Criminal Acts Against Civil Aviation is a publication of the Federal Aviation Administration's Office of Civil Aviation Security. This document records incidents that have taken place against civil aviation aircraft and interests worldwide. Criminal Acts has been published each year since 1986. Incidents recorded in this report are summarized in regional geographic overviews. Feature articles focus on case histories or on specific aviation-related issues. Incidents are also sorted into one of seven categories and compared over a five-year period. In addition, charts and graphs have been prepared to assist the reader in interpreting the data. The cutoff date for information in this report is December 31, 2000. One change in this year's edition is that the Asia geographic area has been renamed as 'Asia and the Pacific.' This has been done to better reflect the incidents that occur in the region. In addition, a corrected page for an incident that appeared in last year's issue has also been added and can be found at the end of the 'Europe' geographical area section. The information contained in this publication is derived from a variety of foreign and domestic sources. In many cases, however, specific details of a particular incident may not be available, especially if it occurs outside the USA. While every effort has been made to provide complete

and accurate information, it is not always possible to verify accounts of some incidents.

NTIS

Civil Aviation; Security; Terrorism

20030067445 Technische Univ., Delft

Pilot Workload and Operational Aircraft Safety

vandenBerg, A. E.; Aug. 1998; 112 pp.; In English

Report No.(s): PB2003-104378; M-484; Copyright; Avail: National Technical Information Service (NTIS)

This report presents an exploratory study into a theory on the relationship between the operational aircraft safety and pilot workload. The pilot is defined overloaded when workload rises beyond the capacity of the pilot's capabilities. It is assumed that the margin between this so-called boundary of saturation and the actual workload reflects the available or residual attention of the pilot, which is called upon in case of unexpected events or sudden emergency situations. A proposal is made to assess the workload resulting from the Flight Management sub-task, consisting of analytical workload assessment techniques based on Wicken's multiple-resources theory from the field of engineering psychology. Quantification of manual control task workload is done by working out some of the ideas by Padfield from the field of military helicopter flying qualities. Padfield suggests a technique for the calculation of the 'energy applied by the pilot' due to manual control. By means of a workload metric this energy can then be translated to a measure for the pilot workload. An initial validation has been performed by two engineering pilots in a simulator session. Some of the approach procedures were flown, and performance data was recorded for a manual control task workload calculation. Besides this, a very crude timeline task analysis was carried out with the use of an audio-recording of the pilots while flying the procedures.

NTIS

Aircraft Pilots; Workloads (Psychophysiology); Aircraft Safety; Manual Control

20030067481 Hubbs-Sea World Research Inst., San Diego, CA

Evaluation of the Potential Impacts of Launches of the USAF Atmospheric Interceptor Technology (AIT) Test Vehicle from the Kodiak Launch Complex (KLC) on Threatened and Endangered Species of Wildlife. Launch of AIT on 5 November 1998, 1632 Hrs. PST

Stewart, Brent S.; Nov. 5, 1998; 15 pp.; In English

Report No.(s): AD-A414326; HSWRI/TR-099-291; No Copyright; Avail: CASI; [A03](#), Hardcopy

As part of the monitoring and mitigation obligation of the USA Air Force (USAF) atmospheric interceptor technology (ait) program Environmental Assessment, the USAF has conducted noise monitoring at the Kodiak Launch Complex, Kodiak Alaska. Two special status species, Steller's eider and Steller Sea Lions; both federally listed as threatened and endangered species are of concern at the launch site. As a result, sound measuring and recording instruments were placed at three strategic locations. The frequency content of the noise event was mostly below 4 kHz with a substantial amount of energy at frequencies of 100 to 500 Hz. We have compared the measured A weighted sound levels (ASEL) and the A weighted maximum sound pressure levels (Lmax) to prelaunch calculations of the sound level contours. The measured sound levels were similar to the calculated values, within the limits of the predictions. The effects of the launch noise on the endangered species will be discussed.

DTIC

Endangered Species; Wildlife; Launch Vehicles; Launching Sites

20030067487 Civil Aeromedical Inst., Oklahoma City, OK

A Human Error Analysis of General Aviation Controlled Flight into Terrain Accidents Occurring Between 1990-1998

Shappell, Scott A.; Wiegmann, Douglas A.; Mar. 1998; 26 pp.; In English

Report No.(s): AD-A413731; DOT/FAA/AM-03/4; No Copyright; Avail: CASI; [A03](#), Hardcopy

Although all aviation accidents are of interest to the Federal Aviation Administration (FAA), perhaps none is more disconcerting than those in which a fully functioning aircraft is inexplicably flown into the ground. Referred to as controlled flight into terrain (CFIT), these accidents continue to be a major safety concern within aviation, in particular general aviation (GA). A previous study as part of the FAA's Safer Skies agenda examined 165 CFIT accidents using root cause analysis and developed 55 interventions to address their causes. While the study represented the work and opinions of several experts in the FAA and industry, the findings might have benefited from a more detailed human error analysis involving a larger number of accidents. In this study, five pilot-raters independently analyzed more than 16,500 GA accidents occurring between 1990-1998 using the Human Factors Analysis and Classification System (HFACS). Of the GA accidents examined, 1407 were

identified as CFIT and compared with non-CFIT accidents using HFACS. The analysis revealed a number of differences in the pattern of human error associated with CFIT accidents. Findings from this study support many of the interventions identified by the CFIT Joint Safety Analysis Team (JSAT) and Joint Safety implementation Team (JSIT), permitting safety professionals to better develop, refine, and track the effectiveness of selected intervention strategies.

DTIC

Aircraft Accidents; General Aviation Aircraft; Terrain; Pilot Error; Human Factors Engineering

20030067638 NordicTransport Research, Trondheim, Norway

NTF Seminar on Nordic Air Transport Research

Nov. 1999; 194 pp.; In English; NTF Seminar on Nordic Air Transport Research, 24 - 25 November, 1999, Gothenburg, Sweden

Report No.(s): PB2003-105144; KONFERENSRAPPORT-1999:2; No Copyright; Avail: CASI; [A09](#), Hardcopy

NTF arranged a conference on Nordic Air Transport Research in Gothenburg 24-25 November 1999. The conference addressed both researchers, managers of research institutes and those who finance research and of course users of the results as well. Two main topics were dealt with: 'Competition and deregulation on the air traffic market in the Nordic countries' and 'The future development of air transport on a global basis with emphasis on the possible development in this part of the world'.

NTIS

Air Traffic; Air Transportation

04

AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also *06 Avionics and Aircraft Instrumentation*, *17 Space Communications, Spacecraft Communications, Command and Tracking*, and *32 Communications and Radar*.

20030067407 Lockheed Martin Aeronautics Co Fort Worth TX, Fort Worth, TX, USA

Automatic Air Collision Avoidance System

Ikeda, Y.; Nguyen, B.; Barfield, A.; Sundqvist, B.; Jones, S.; Jun. 2002; 8 pp.; In English

Contract(s)/Grant(s): F33615-01-2-3103; Proj-486U

Report No.(s): AD-A414370; AFRL-VA-WP-TP-2002-317; No Copyright; Avail: CASI; [A02](#), Hardcopy

This paper presents an algorithm for an Automatic Air Collision Avoidance System under development by the U.S. Air Force and its Swedish counterpart Forsvaret Materielverk (FMV). The algorithm uses optimal coordinated escape maneuvers to avoid mid-air collision, while satisfying the imposed system requirements. In addition, the algorithm can simultaneously accommodate multiple aircraft in a collision course by activating the coordinated escape maneuvers. On the other hand, the algorithm has logic to allow close formation flight and rejoin without activating the escape maneuver. The algorithm is designed to operate safely against failure and GPS/data link dropout.

DTIC

Air Traffic Control; Collision Avoidance; Warning Systems; Algorithms

05

AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information see also *18 Spacecraft Design, Testing and Performance*; and *39 Structural Mechanics*. For land transportation vehicles see *85 Technology Utilization and Surface Transportation*.

20030066251

A Comparison of Nonlinear Algorithms to Prevent Pilot-Induced Oscillations Caused by Actuator Rate Limiting

Henley, James G.; Mar. 2003; 107 pp.; In English; Original contains color illustrations

Report No.(s): AD-A413992; AFIT/GAE/ENY/03-4; No Copyright; Avail: CASI; [A06](#), Hardcopy

The objective of this study was to compare the ability of the Feedback-with-Bypass (FWB) and the Derivative-Switching (DS) flight control system filters to prevent PIO during actuator rate limiting, and the filters' effects on aircraft handling qualities. This comparison was conducted in three steps: computer simulation, ground simulation in the Large Amplitude Multimode Aerospace Research Simulator (LAMARS), and flight tests conducted in the Variable Stability In-flight Simulator

Test Aircraft (VISTA). During computer simulation, the FWB filter better reduced the phase lag and prevented sustained or divergent oscillations during the closed-loop analysis. During both ground simulation and flight tests, the FWB filter was more effective at preventing divergent PIO and improving handling qualities. Overall the FWB filter performed better during all tests.

DTIC

Actuators; Flight Management Systems

20030066290 NASA Langley Research Center, Hampton, VA, USA

PIV Measurements in the 14 x 22 Low Speed Tunnel: Recommendations for Future Testing

Watson, Ralph D.; Jenkins, Luther N.; Yao, Chung-Sheng; McGinley, Catherine B.; Paschal, Keith B.; Neuhart, Dan H.; August 8, 2003; 21 pp.; In English

Contract(s)/Grant(s): WU 23-762-20-11

Report No.(s): NASA/TM-2003-212434; L-18304; NAS 1.15:212434; No Copyright; Avail: CASI; [A03](#), Hardcopy

During the period from February 4 to March 21, 2003 stereo digital particle imaging velocimetry measurements were made on a generic high lift model, the Trap Wing, as part of the High Lift Flow Physics Experiment. These measurements were the first PIV measurements made in the NASA, Langley Research Center 14 x 22 Foot Low Speed Tunnel, and several problems were encountered and solved in the acquisition of the data. It is the purpose of this paper to document the solutions to these problems and to make recommendations for further improvements to the tunnel/setup in order to facilitate future measurements of this type.

Author

Wind Tunnels; Wind Tunnel Tests; Low Speed; Data Acquisition; Fluid Dynamics

20030066342 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA

Cargo Aircraft Bombing System (CABS)

Gurler, Ari; Mar. 2003; 106 pp.; In English; Original contains color illustrations

Report No.(s): AD-A413018; AFIT/GSO/ENY/03-01; No Copyright; Avail: CASI; [A06](#), Hardcopy

From the early days of aviation, bombs typically have been carried by either fighter or bomber aircraft in the inventory. On the other hand, more and more long-range, precision-guided missiles are being produced with ranges that vary from tens to hundreds of miles. With such missiles, targets can be destroyed without placing personnel and equipment into close proximity to the targets. The mass delivery of standoff weapons could be especially advantageous during the early phases of an air campaign. This study considers the use of cargo aircraft for carrying and launching bombs and missiles. It discusses many aspects of a Cargo Aircraft Bombing System (CABS) and provides an overall view. The intention of the study was not to complete design details about CABS, but rather to identify preliminary design concepts that need to be considered in a CABS. The study summarizes current knowledge on CABS and reviews the Air Force's BLU-82 Commando Vault (Daisy Cutter) bomb and the Royal Air Force's Future Offensive Air System (FOAS). Background information (i. e., physical characteristics, performance, and operations) is provided on four carrying platforms, including the C-17, C-141, C-130 and C-5, and four types of precision-guided missiles, including the JSOW, JASSM, SLAM-ER, and LOCAAS. Large numbers of missiles can be carried in cargo aircraft based on operational mass restrictions. Normally, a full load would not be carried in each sortie with CABS. Based on missile and aircraft availability, and a given mission, a particular number of missiles could be carried. The problem is how to place and carry these missiles on board. Three types of carriage and release systems are proposed: Tray/Spring-type carrier/launcher, Rotary-type carrier/launcher, and Tray/Chute Extraction-type carrier/launcher. (15 tables, 26 figures, 95 refs.)

DTIC

Transport Aircraft; Bomber Aircraft; Cargo Aircraft; Supersonic Low Altitude Missile

20030066886 NASA Langley Research Center, Hampton, VA, USA

Aeroacoustic Analysis of a Simplified Landing Gear

Lockard, David P.; Khorrami, Mehdi R.; Li, Fei; [2003]; 12 pp.; In English; 10th AIAA/CEAS Aeroacoustics Conference, 12-14 May 2003, Hilton Head, SC, USA; Original contains color and black and white illustrations

Report No.(s): AIAA Paper 2003-3111; Copyright; Avail: Other Sources

This paper investigates the noise generated by a simplified landing gear without small scale parts such as hydraulic lines and fasteners. The Ffowcs Williams and Hawkings equation is used to predict the noise at far-field observer locations from surface pressure data provided by an unsteady computational fluid dynamics calculation. Beyond prediction, the analysis

involves identifying the parts of the landing gear responsible for different features in the spectra. Because of the simplified nature of the model, most of the unsteadiness is restricted to low frequencies. The gear boxes and oleo appear to be the primary sources of unsteadiness at these frequencies. Interpretation of the data is complicated by discretization errors at grid blocks with patched boundaries in the computational fluid dynamics calculation which appear to be dominant on the flat plate above the gear. Nonetheless, the calculations demonstrate the utility of large scale computations for improving the understanding of landing gear noise.

Author

Landing Gear; Aircraft Noise; Prediction Analysis Techniques; Aeroacoustics

20030066891 Defence Science and Technology Organisation, Fishermans Bend, Australia

Experimental Verification of Helicopter-Rotor Loads-Synthesis Models

Polanco, Frank G.; Knight, Chris G.; Dutton, Scott A.; Ferrarotto, Phil; May 2003; 41 pp.; In English; Original contains black and white illustrations

Report No.(s): DSTO-TR-1428; DODA-AR-012-759; Copyright; Avail: Other Sources

Accurately synthesizing the load in helicopter-rotor components, using measurements taken from fixed components, has the potential to increase safety and reduce operating costs. Two synthesis models, one of which is able to handle noisy and collinear environments, were validated using data from a Eurocopter Squirrel gearbox fitted to DSTO's Helicopter Transmission Test Facility. The aim of the experiment was to test the models under challenging conditions-namely, a noisy and collinear measurement environment. Despite the synthesis techniques being validated, the testing environment did not prove challenging enough (mainly due to insufficient collinearity between the strain gauges). Both the instrumental variable (IV) and least squares (LS) models were able to synthesize the required loads to a high degree of accuracy. The IV model (unlike the LS model) was found to be very sensitive to the chosen gauge combination.

Author

Military Helicopters; Test Facilities; Transmissions (Machine Elements); Loads (Forces); Rotor Dynamics; Mathematical Models

20030066907 NASA Langley Research Center, Hampton, VA, USA

Multiple Input Design for Real-Time Parameter Estimation in the Frequency Domain

Morelli, Eugene; [2003]; 7 pp.; In English; 13th IFAC Conference on System Identification, 27-29 Aug. 2003, Rotterdam, Netherlands

Report No.(s): Paper REG-360; Copyright; Avail: CASI; [A02](#), Hardcopy

A method for designing multiple inputs for real-time dynamic system identification in the frequency domain was developed and demonstrated. The designed inputs are mutually orthogonal in both the time and frequency domains, with reduced peak factors to provide good information content for relatively small amplitude excursions. The inputs are designed for selected frequency ranges, and therefore do not require a priori models. The experiment design approach was applied to identify linear dynamic models for the F-15 ACTIVE aircraft, which has multiple control effectors.

Author

Experiment Design; Estimating; Frequency Domain Analysis; Aircraft Models; Control Equipment; Real Time Operation

20030067198 National Academy of Sciences - National Research Council, Washington, DC, USA

Review of ONR's Uninhabited Combat Air Vehicles Program

Jan. 2000; 55 pp.; In English

Report No.(s): AD-A413246; No Copyright; Avail: CASI; [A04](#), Hardcopy

At the request of the Office of Naval Research (ONR), the National Research Council established a committee, under the auspices of the Naval Studies Board, to review ONR's uninhabited combat air vehicles (UCAVs) program. The primary program review was held December 13-15, 1999. For program context, a series of briefings by other Department of Defense and Department of the Navy organizations involved in related unmanned aerial vehicle (UAV) and UCAV activities were presented to the committee on January 18-19, 2000. This report is based on the information presented at those meetings and on the committee members accumulated experience and expertise in military operations, systems, and technology. The Navy UCAV picture is changing rapidly, and this report necessarily reflects the status at the time the information was presented.

DTIC

Aircraft; Pilotless Aircraft; Combat

20030067204 California Univ., Berkeley, CA

Hierarchical System for Multiple-Agent Scenarios

Kim, H. J.; Shim, David H.; Rashid, Shahid; Sastry, Shankar; Jan. 2002; 9 pp.; In English

Contract(s)/Grant(s): DAAH04-96-1-0341; N0014-97-1-0946

Report No.(s): AD-A413497; ARO-35873.177-MA-MUR; No Copyright; Avail: CASI; [A02](#), Hardcopy

This paper presents a hierarchical architecture for the coordination and control of autonomous agents performing intelligent team operations. Each team consisting of multiple aerial and ground vehicles, uses a coordinated strategy through communication via a wireless network. As an exemplary case study, a pursuit-evasion scenario is developed. This paper also introduces the experimental setup for aerial and ground-based autonomous agents. The proposed scheme is currently under development for near future experiments.

DTIC

Autonomy; Control Systems Design; Systems Engineering; Wireless Communication

20030067254 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA

Application of Maneuver-Based Control In Variable Autonomy Unmanned Combat Aerial Vehicles

Walan, Alexander M.; Mar. 2003; 112 pp.; In English; Original contains color illustrations

Report No.(s): AD-A413611; AFIT/GAE/ENY/03-09; No Copyright; Avail: CASI; [A06](#), Hardcopy

The rise in the capability and lethality of unmanned combat aerial vehicles (UCAVs) historically has been paralleled by an increase in the complexity of the command and control of these systems. This trend has continued with the command and control of the current fleet of unmanned aerial vehicles such as the Predator and Global Hawk. The control of these vehicles falls on the extremes on the manual vs autonomous spectrum. As the missions tasked to these vehicles increase in complexity and lethality, operators will increasingly require the ability to tailor the amount of control exercised over the vehicle. Maneuver Based Control (MBC) offers the potential to give future UCAV operators the ability to vary the autonomy of the vehicle against the amount of control they exercise over UCAV systems. The objective of this research is to validate the concept of Maneuver Based Control (MBC). This is accomplished under the umbrella of a conceptual UCAV mission. Particular attention is paid to the ability of this control scheme to increase operator situational awareness while decreasing the overall operator workload and required piloting skill. In addition, the ability to MBC to ensure effective control integrity over the vehicle is examined; ensuring that what vehicle does in response to a user's input is not divorced from the flight characteristics of vehicle.

DTIC

Flight Characteristics; Pilotless Aircraft

20030067274 Air Force Research Lab., Wright-Patterson AFB, OH

Enhancement of Transonic Airfoil Performance Using Pulsed Jets for Separation Control

Tilman, Carl P.; Jan. 2001; 14 pp.; In English

Contract(s)/Grant(s): Proj-2304

Report No.(s): AD-A413925; AFRL-VA-WP-TP-2003-309; AIAA-2001-0731; No Copyright; Avail: CASI; [A03](#), Hardcopy

Selected active and passive flow control devices have been investigated for their possible improvements to transonic airfoil performance. These investigations are part of co-operative effort between the U.S.'s Air Force Research Laboratory (AFRL) and the UK's Defense Evaluation and Research Agency (DERA) to explore flow control concepts. In particular, this manuscript reports on an experimental demonstration of pulsed vortex generator jets (PVGJs) conducted in DERA's High Speed Tunnel in Bedford. The primary goal of this test was to demonstrate the effectiveness of using PVGJs to suppress shock-induced separation of a transonic airfoil. It had yet to be demonstrated that this control technique would result in a net performance improvement. The influence of pulsing frequency on performance was evaluated over a range of lift conditions. The experiments were conducted at Mach numbers from 0.67 to 0.71, yielding chord Reynolds numbers of about 19 million.

DTIC

Airfoils; Vortex Generators

20030067301 Army War Coll., Carlisle Barracks, PA

Unmanned Aerial Vehicles: Replacing the Army's Comanche Helicopter?

Thome, Joseph E., Jr.; Apr. 7, 2003; 53 pp.; In English

Report No.(s): AD-A414557; No Copyright; Avail: CASI; [A04](#), Hardcopy

This strategic research project explores the possibility of unmanned aerial vehicles replacing the Comanche Helicopter in its doctrinal missions. This research consolidates the aviation critical tasks required to support reconnaissance, security, and

movement-to-contact missions, evaluates the capabilities of unmanned aerial vehicles, and analyzes unmanned aerial vehicles capabilities against those aviation critical tasks. This research will also consider likely future unmanned aerial vehicle capabilities as well. Though key UAV capabilities are equal to or better than similar systems in the Army's current helicopters, this analysis reveals that unmanned aerial vehicles can only perform 67% of the reconnaissance critical tasks, 50% of the security critical tasks, and 25% of the movement-to-contact critical tasks required to achieve mission success. These percentages demonstrate that unmanned aerial vehicles cannot fulfill the role of the Comanche Helicopter.

DTIC

Helicopters; Remotely Piloted Vehicles; Military Helicopters; Pilotless Aircraft

20030067312 Defence Research and Development Canada, Ottawa, Ontario, Canada

Effect of the 'Long Term Solution' Seat Pack on Harvard II (CT156) Aircrew Accommodation

Murphy, Pierre; Feb. 2003; 37 pp.; In English

Report No.(s): AD-A414475; DRDC-TR-2003-172; No Copyright; Avail: CASI; [A03](#), Hardcopy

The requirement to include additional survival equipment as part of the seat survival kit of the Harvard II has caused a significant increase to the seat thickness (4 to 5 cm). A previous study determined that any increase in seat thickness would likely have repercussions on the ability of the taller individuals to see all of the information displayed by the Electronic Attitude Director Indicator (EADI), on control stick authority, and possibly on helmet to canopy clearance. The object of this study was to assess the impact of this new seat pack, or Long Term Solution (LTS) seat pack, on pilot accommodation. The study found that approximately 12% to 17% of student pilots (i.e. individuals in the front seat) would not be able to see all of the EADI information. In addition, the taller 2% to 3% of pilots would likely exceed the aircraft's maximum sitting height limits and have insufficient clearance between the top of the helmet and the canopy. Stick authority was relatively little affected by the proposed seat compared to the baseline. Removal of the g-suit from the winter clothing configuration significantly improved stick authority.

DTIC

Flight Crews; Seats; Survival Equipment; Clothing

20030067333 National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, CA, USA

Flow Over Inclined Bodies

Perkins, E. W.; Gowen, F. E.; Aerodynamic Characteristics of Bodies at Supersonic Speeds: A Collection of Three Papers; November 9, 1951, pp. 31-44; In English; NACA Conference on Aerodynamic Design Problems of Supersonic Guided Missiles, 2-3 Oct. 1951, Moffett Field, CA, USA; See also 20030067330; Original contains black and white illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy

It has been shown that the circumferential pressure distributions for the inclined body and circular cylinder deviate from their respective theoretical inviscid distributions on the lee or downstream side in the same manner. With the aid of visual flow techniques, it has been shown that there is a shedding of vortices within the crossflow field of the inclined body. It has also been found that the vortex configuration depends to a large extent on the shape of the nose of the body. To illustrate this, vapor screen pictures were made and results are discussed.

CASI

Pressure Distribution; Inviscid Flow; Vortices; Nose Cones; Missiles

20030067391 California Univ., Los Angeles, CA

Developing Innovative Mesoscale Actuator Devices for Use in Rotorcraft Systems

Carman, Greg P.; Dunn, Bruce; Friedman, Peretz; Hahn, Tom; Ho, Chih-Ming; Jan. 22, 2002; 18 pp.; In English

Contract(s)/Grant(s): DAAH04-95-1-0095

Report No.(s): AD-A414612; ARO-33894.27-MS-MUR; No Copyright; Avail: CASI; [A03](#), Hardcopy

The primary goal of this MURI was to develop a superior mesoscale piezoelectric actuator device when compared to conventional smart actuation systems. The secondary goal was to evaluate the potential use of the device in rotorcraft systems to alter fluid-structure interactions and to decrease vibration loads and/or alleviate dynamic stall. The piezoelectric activated device utilized frequency rectification concepts along with single crystal silicon micro-machined gears to produce step-like motions amplifying the displacement output of conventional piezoelectric stacks from microns to millimeters. The order of magnitude displacement improvement was also reflected in an order of magnitude increased power output of the system when operated in structural systems such as the rotorcraft. Accomplishing this goal required several fundamental science and engineering questions to be addressed. These included but were not limited to the long term electro-mechanical fatigue of

piezoelectrics, the intrinsic strength of single crystal MEMS components, mesoscale manufacturing concepts, and development of thin film lithium batteries. In regards to Rotorcraft applications, experimental and analytical studies indicated substantial reductions in vibrations up to 90% along with alleviation of dynamic stall.

DTIC

Actuators; Rotary Wing Aircraft; Aerodynamic Stalling; Loads (Forces); Microelectromechanical Systems

20030067408 Defence Science and Technology Organisation, Victoria, Australia

A Review of Australian and New Zealand Investigations on Aeronautical Fatigue During the Period April 2001 to March 2003

Clark, Graham; Apr. 2003; 77 pp.; In English; Original contains color illustrations

Report No.(s): AD-A414439; DSTO-TN-0489; DODA-AR-012-725; X5-X5; No Copyright; Avail: CASI; [A05](#), Hardcopy

This document has been prepared for presentation to the 28th Conference of the International Committee on Aeronautical Fatigue scheduled to be held in Lucerne Switzerland, 5th and 6th May 2003. Brief summaries and references are provided on the aircraft fatigue research and associated activities of research laboratories, universities, and aerospace companies in Australia and New Zealand during the period April 2001 to March 2003. The review covers fatigue-related research programs as well as fatigue investigations on specific military and civil aircraft.

DTIC

Aeronautical Engineering; Structural Analysis; Fatigue (Materials); Fatigue Tests

06

AVIONICS AND AIRCRAFT INSTRUMENTATION

Includes all avionics systems, cockpit and cabin display devices, and flight instruments intended for use in aircraft. For related information see also *04 Aircraft Communications and Navigation*; *08 Aircraft Stability and Control*; *19 Spacecraft Instrumentation and Astrionics*; and *35 Instrumentation and Photography*.

20030066934 NASA Dryden Flight Research Center, Edwards, CA, USA

Flight Demonstration of X-33 Vehicle Health Management System Components on the F/A-18 Systems Research Aircraft

Schweikhard, Keith A.; Richards, W. Lance; Theisen, John; Mouyos, William; Garbos, Raymond; December 2001; 16 pp.; In English; 19th Digital Avionics Systems Conference, 7-11 Oct. 2000, Philadelphia, PA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): WU 529-35-34-E8-RR

Report No.(s): NASA/TM-2001-209037; H-2435; NAS 1.15:209037; No Copyright; Avail: CASI; [A03](#), Hardcopy

The X-33 reusable launch vehicle demonstrator has identified the need to implement a vehicle health monitoring system that can acquire data that monitors system health and performance. Sanders, a Lockheed Martin Company, has designed and developed a COTS-based open architecture system that implements a number of technologies that have not been previously used in a flight environment. NASA Dryden Flight Research Center and Sanders teamed to demonstrate that the distributed remote health nodes, fiber optic distributed strain sensor, and fiber distributed data interface communications components of the X-33 vehicle health management (VHM) system could be successfully integrated and flown on a NASA F-18 aircraft. This paper briefly describes components of X-33 VHM architecture flown at Dryden and summarizes the integration and flight demonstration of these X-33 VHM components. Finally, it presents early results from the integration and flight efforts.

Author

X-33 Reusable Launch Vehicle; Systems Health Monitoring; Management Systems; Systems Integration; Flight Tests

07

AIRCRAFT PROPULSION AND POWER

Includes primary propulsion systems and related systems and components, e.g., gas turbine engines, compressors, and fuel systems; and onboard auxiliary power plants for aircraft. For related information see also *20 Spacecraft Propulsion and Power*; *28 Propellants and Fuels*; and *44 Energy Production and Conversion*.

20030066318 NASA Glenn Research Center, Cleveland, OH, USA

Integrated Fuel Injection and Mixing System with Impingement Cooling Face

Mansour, Adel B., Inventor; Harvey, Rex J., Inventor; Tacina, Robert R., Inventor; Laing, Peter, Inventor; April 22, 2003; 23 pp.; In English

Patent Info.: Filed 27 Feb. 2001; No Copyright; Avail: CASI; [A03](#), Hardcopy

An atomizing injector includes a metering set having a swirl chamber, a spray orifice and one or more feed slots etched in a thin plate. The swirl chamber is etched in a first side of the plate and the spray orifice is etched through a second side to the center of the swirl chamber. Fuel feed slots extend non-radially to the swirl chamber. The injector also includes integral swirler structure. The swirler structure includes a cylindrical air swirler passage, also shaped by etching, through at least one other thin plate. The cylindrical air swirler passage is located in co-axial relation to the spray orifice of the plate of the fuel metering set such that fuel directed through the spray orifice passes through the air swirler passage and swirling air is imparted to the fuel such that the fuel has a swirling component of motion. At least one air feed slot is provided in fluid communication with the air swirler passage and extends in non-radial relation thereto. Air supply passages extend through the plates of the metering set and the swirler structure to feed the air feed slot in each plate of the swirler structure.

Author

Fuel Injection; Impingement; Cooling; Mixing; Injectors; Atomizing; Swirling

20030066875 NASA Glenn Research Center, Cleveland, OH, USA

Electrical Systems Analysis at NASA Glenn Research Center: Status and Prospects

Freeh, Joshua E.; Liang, Anita D.; Berton, Jeffrey J.; Wickenheiser, Timothy J.; August 2003; 17 pp.; In English; Novel Vehicle Concepts and Emerging Vehicle Technologies Symposium, 7-10 Apr. 2003, Brussels, Belgium; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 22-706-88-03

Report No.(s): NASA/TM-2003-212520; E-14082; NAS 1.15:212520; No Copyright; Avail: CASI

An analysis of an electrical power and propulsion system for a 2-place general aviation aircraft is presented to provide a status of such modeling at NASA Glenn Research Center. The thermodynamic/ electrical model and mass prediction tools are described and the resulting system power and mass are shown. Three technology levels are used to predict the effect of advancements in component technology. Methods of fuel storage are compared by mass and volume. Prospects for future model development and validation at NASA as well as possible applications are also summarized.

Author

General Aviation Aircraft; Electric Propulsion; Fuel Cells; Electric Motors; Thermodynamics

20030067315 Massachusetts Inst. of Tech., Cambridge, MA, USA

Three-dimensional Aerodynamic Instability in Multi-stage Axial Compressors

Suder, Kenneth, Technical Monitor; Tan, Choon-Sooi; May 2003; 445 pp.; In English; See also 20030067316 - 20030067319; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAG3-2101; No Copyright; Avail: CASI; [A19](#), Hardcopy

Four separate tasks are reported. The first task: A Computational Model for Short Wavelength Stall Inception and Development In Multi-Stage Compressors; the second task: Three-dimensional Rotating Stall Inception and Effects of Rotating Tip Clearance Asymmetry in Axial Compressors; the third task: Development of an Effective Computational Methodology for Body Force Representation of High-speed Rotor 37; and the fourth task: Development of Circumferential Inlet Distortion through a Representative Eleven Stage High-speed axial compressor. The common theme that threaded throughout these four tasks is the conceptual framework that consists of quantifying flow processes at the compressor blade passage level to define the compressor performance characteristics needed for addressing physical phenomena such as compressor aerodynamic instability and compressor response to flow distortion with length scales larger than compressor blade-to-blade spacing at the system level. The results from these two levels can be synthesized to: (1) simulate compressor aerodynamic instability inception local to a blade rotor tip and its development from a local flow event into the nonlinear limit cycle instability that involves the entire compressor as was demonstrated in the first task; (2) determine the conditions under which compressor stability assessment based on two-dimensional model may not be adequate and the effects of self-induced flow distortion on compressor stability limit as in the second task; (3) quantify multistage compressor response to inlet distortion in stagnation pressure as illustrated in the fourth task; and (4) elucidate its potential applicability for compressor map generation under uniform as well as non-uniform inlet flow given three-dimensional Navier-Stokes solution for each individual blade row as was demonstrated in the third task.

Author

Aerodynamic Characteristics; Turbocompressors; Rotors; Compressor Blades

20030067316 Massachusetts Inst. of Tech., Cambridge, MA, USA

Task IV: Development of Circumferential Inlet Distortion through a Representative Eleven Stage High-speed Axial Compressor

Tan, Choon-Sooi; Suder, Kenneth, Technical Monitor; Three-dimensional Aerodynamic Instability in Multi-stage Axial Compressors; May 2003, pp. 430-453; In English; See also 20030067315; Original contains black and white illustrations Contract(s)/Grant(s): NAG3-2101; No Copyright; Avail: CASI; [A03](#), Hardcopy

The concepts and the procedure developed in Task I and Task III were used to determine the response of an eleven-stage high-speed compressor to an inlet distortion of 180 deg. circumferential extent for contrasting against its performance under uniform inlet flow. Using the computed results at the inlet to and outlet of the compressor, the computed total pressure ratio and efficiency for the clean condition are determined to be 14.22 and 76.9 percent respectively. As for the distorted case, these are determined to be 10.35 and 71.8 percent respectively, showing deterioration 76.9 percent vs 71.8 percent). The physical consistency of the computed flow field was assessed as a means of demonstrating the applicability and utility of the body force representation for inlet distortion computations. Specifically the computed evolution of the distorted pattern in static pressure and total pressure from compressor inlet to exit is examined. For the eleven-stage compressor examined here, the deterioration in performance has been found to be particularly severe in the last 2 stages. This suggests that the last two stages could be redesigned to alleviate the observed deterioration thus making the compressor performance insensitive to circumferential inlet distortion. This can potentially be accomplished by first determining what should the body force distribution of the last two stages should be to achieve minimal or no deterioration in performance in the last two stages. One can then in principle proceed to determine the blade design to yield such a body force distribution.

Author

Turbocompressors; Axial Flow; Compressor Blades

20030067317 Massachusetts Inst. of Tech., Cambridge, MA, USA

Task I: A Computational Model for Short Wavelength Stall Inception and Development In Multi-Stage Compressors

Suder, Kenneth, Technical Monitor; Tan, Choon-Sooi; Three-dimensional Aerodynamic Instability in Multi-stage Axial Compressors; May 2003, pp. 1-21; In English; See also 20030067315; Original contains black and white illustrations Contract(s)/Grant(s): NAG3-2101; No Copyright; Avail: CASI; [A03](#), Hardcopy

A computational model is presented for simulating axial compressor stall inception and development via disturbances with length scales on the order of several (typically about three) blade pitches. The model was designed for multi-stage compressors in which stall is initiated by these short wavelength disturbances, also referred to as spikes. The inception process described is fundamentally nonlinear, in contrast to the essentially linear behavior seen in so-called modal stall inception. The model was able to capture the following experimentally observed phenomena: (1) development of rotating stall via short wavelength disturbances, (2) formation and evolution of localized short wavelength stall cells in the first stage of a mismatched compressor, (3) the switch from long to short wavelength stall inception resulting from the re-staggering of the inlet guide vane, (4) the occurrence of rotating stall inception on the negatively sloped portion of the compressor characteristic. Parametric investigations indicated that (1) short wavelength disturbances were supported by the rotor blade row, (2) the disturbance strength was attenuated within the stators, and (3) the reduction of inter-blade row gaps can suppress the growth of short wavelength disturbances. It is argued that each local component group (rotor plus neighboring stators) has its own instability point (i.e. conditions at which disturbances are sustained) for short wavelength disturbances, with the instability point for the compressor set by the most unstable component group.

Author

Turbocompressors; Rotating Stalls

20030067318 Massachusetts Inst. of Tech., Cambridge, MA, USA

Task III: Development of an Effective Computational Methodology for Body Force Representation of High-speed Rotor 37

Tan, Choon-Sooi; Suder, Kenneth, Technical Monitor; Three-dimensional Aerodynamic Instability in Multi-stage Axial Compressors; May 2003, pp. 389-429; In English; See also 20030067315; Original contains black and white illustrations Contract(s)/Grant(s): NAG3-2101; No Copyright; Avail: CASI; [A03](#), Hardcopy

A framework for an effective computational methodology for characterizing the stability and the impact of distortion in high-speed multi-stage compressor is being developed. The methodology consists of using a few isolated-blade row Navier-Stokes solutions for each blade row to construct a body force database. The purpose of the body force database is to replace each blade row in a multi-stage compressor by a body force distribution to produce same pressure rise and flow turning. To do this, each body force database is generated in such a way that it can respond to the changes in local flow

conditions. Once the database is generated, no further Navier-Stokes computations are necessary. The process is repeated for every blade row in the multi-stage compressor. The body forces are then embedded as source terms in an Euler solver. The method is developed to have the capability to compute the performance in a flow that has radial as well as circumferential non-uniformity with a length scale larger than a blade pitch; thus it can potentially be used to characterize the stability of a compressor under design. It is these two latter features as well as the accompanying procedure to obtain the body force representation that distinguish the present methodology from the streamline curvature method. The overall computational procedures have been developed. A dimensional analysis was carried out to determine the local flow conditions for parameterizing the magnitudes of the local body force representation of blade rows. An Euler solver was modified to embed the body forces as source terms. The results from the dimensional analysis show that the body forces can be parameterized in terms of the two relative flow angles, the relative Mach number, and the Reynolds number. For flow in a high-speed transonic blade row, they can be parameterized in terms of the local relative Mach number alone.

Author

Turbocompressors; Rotors; Navier-Stokes Equation; Compressor Blades

20030067319 Massachusetts Inst. of Tech., Cambridge, MA, USA

Task II: Three-dimensional Rotating Stall Inception and Effects of Rotating Tip Clearance Asymmetry in Axial Compressors

Suder, Kenneth, Technical Monitor; Tan, Choon-Sooi; Three-dimensional Aerodynamic Instability in Multi-stage Axial Compressors; May 2003, pp. 22-388; In English; See also 20030067315; Original contains black and white illustrations

Contract(s)/Grant(s): NAG3-2101; No Copyright; Avail: CASI; [A16](#), Hardcopy

The effects of two types of flow non-uniformity on stall inception behavior were assessed with linearized stability analyses of two compressor flow models. Response to rotating tip clearance asymmetries induced by a whirling rotor shaft or rotor height variations were investigated with a two-dimensional flow model. A 3-D compressor model was also developed to study the stability of both full-span and part-span rotating stall modes in annular geometries with radial flow variations. The studies focussed on (1) understanding what compressor designs were sensitive to these types of circumferential and spanwise flow non-uniformities, and (2) situations where 2-D stability theories were inadequate because of 3-D flow effects. Rotating tip clearance non-uniformity caused the greatest performance loss for shafts whirling at the rotating stall frequency. A whirling shaft displacement of 1 percent chord caused the stalling mass flow to rise by as much as 10 percent and the peak pressure rise to decrease by 6 percent. These changes were an order of magnitude larger than for equivalent-sized stationary or rotor-locked clearance asymmetries. Spanwise flow non-uniformity always destabilized the compressor, so that 2-D models over-predicted that stall margin compared to 3-D theory. The difference increased for compressors with larger spanwise variations of characteristic slope and reduced characteristic curvature near the peak. Differences between 2-D and 3-D stall point predictions were generally unacceptable (2 - 4 percent of flow coefficient) for single-stage configurations, but were less than 1 percent for multistage compressors. 2-D analyses predicted the wrong stall mode for specific cases of radial inlet flow distortion, mismatching and annulus area contraction, where higher-order radial modes led to stall. The stability behavior of flows with circumferential or radial non-uniformity was unified through a single stability criterion. The stall point for both cases was set by the integral around the annulus of the pressure rise characteristic slope, weighted by the amplitude of the mode shape. For the case of steady circumferential variations, this criterion reduced to the integrated mean slope (IMS) condition associated with steady inlet distortions. The rotating tip clearance asymmetry model was also used to demonstrate the feasibility of actively controlling the shaft position to suppress rotating stall. In axisymmetric mean flow, this method only stabilized the first harmonic mode, increasing the operating range until surge or higher harmonic modes became unstable.

Author

Turbocompressors; Shafts (Machine Elements); Rotating Stalls; Rotors; Flow Stability

20030067356 Technische Univ., Delft, Netherlands

Preliminary Study of a Plug Nozzle Model in Supersonic Flow

Bannink, W. J.; Houtman, E. M.; Schoones, M. M. J.; Apr. 1998; 42 pp.; In English

Report No.(s): PB2003-104782; M-844; Copyright; Avail: National Technical Information Service (NTIS)

Nozzle base pressure measurements and flow visualization results are presented for plug nozzle models with a 6 x 100 mm throat and plug lengths of 30% and 40% referenced to the full plug length. The model was mounted in supersonic free streams of Mach 1.5 and 3.0 produced by the Delft University supersonic wind tunnel ST-15. Measurements without a supersonic free stream were conducted as well. The jet exhausting from the nozzle had a design Mach number of 4.16 and operated at various

jet stagnation pressures, such as to have different jet exit pressure to ambient flow pressure ratios.

NTIS

Plug Nozzles; Supersonic Jet Flow; Flow Distribution

20030067369 Technische Univ., Aachen, Germany

Gas-Dynamic Investigations of the Pulse-Jet Tube, Parts 1 and 2

Shultz-Grunow, F.; February 1947; 113 pp.; In English

Report No.(s): NACA-TM-1131; No Copyright; Avail: CASI; [A06](#), Hardcopy

Based upon a simplified representation of the mode of operation of the pulse-jet tube, the effect of the influences mentioned in the title were investigated and it will be shown that, for a jet tube with a form designed to be aerodynamically favorable, the ability to operate is at least questionable. By taking into account the course of the development of pressure by combustion, a new insight has been obtained into the processes of motion within the jet tube, an insight that explains a number of empirical observations, namely: certain particulars of the sequence of pressure variations; the existence of an optimum valve-opening ratio; the occurrence of an intrusion of air; and the existence of a flight speed above which the jet tube ceases to operate. At too great an opening ratio or at too great a flight speed, the continuous flow through the tube is too predominant over the oscillatory process to permit the occurrence of an explosion powerful enough to maintain continuous operation. Certain possible means of making the operation of the jet tube more independent of the flight speed and of reducing the flow losses were proposed and discussed.

Author

Leakage; Combustion; Valves

08

AIRCRAFT STABILITY AND CONTROL

Includes flight dynamics, aircraft handling qualities, piloting, flight controls, and autopilots. For related information see also *05 Aircraft Design, Testing and Performance* and *06 Avionics and Aircraft Instrumentation*.

20030066273 Georgia Inst. of Tech., Atlanta, GA

Hierarchical Robust and Adaptive Nonlinear Control Design

Haddad, Wassim M.; Feb. 20, 2003; 50 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0095

Report No.(s): AD-A413721; AFRL-SR-AR-TR-03-0151; No Copyright; Avail: CASI; [A03](#), Hardcopy

The authors proposed the development of a general multiechelon hierarchical nonlinear switching control design framework that minimizes control law complexity subject to the achievement of control law robustness. In particular, a unified dynamical systems framework for a general class of systems possessing left-continuous flows was developed. This report also discusses hybrid control, impulsive dynamical systems, nonnegative dynamical systems, compartmental systems, nonlinear switching control, and adaptive control. Areas of application for these control systems include biological systems, physiological systems, pharmacological systems, ecological systems, vibration control of aerospace structures, spacecraft stabilization, and control of combustion in jet engines.

DTIC

Nonlinear Systems; Control Theory; Adaptive Control

20030066283

Mechanisms of Hypersonic Transition on a Generic Scramjet Forebody

Schneider, Steven P.; Reed, Helen L.; Feb. 27, 2003; 40 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0016

Report No.(s): AD-A413763; AFRL-SR-AR-TR-03-0121; No Copyright; Avail: CASI; [A03](#), Hardcopy

This grant supported measurements and computations of laminar-turbulent transition on a generic scramjet forebody. The computations, described in the appendix, were carried out under a subcontract. The experiments were carried out using the new Boeing/AFOSR Mach-6 Quiet Tunnel (BAM6QT). Much of the experimental effort was expended in the first phase, completion and development of the necessary tunnel, which took longer than expected. Furthermore, although the tunnel was operational in April 2001, it is still not running quiet at significant Reynolds numbers. However, the tunnel is already successful at providing low-cost operation. The work carried out at Purdue has already been documented in a series of AIAA papers and other publications. Therefore, the present final report is a summary of past progress, current issues, and future

plans. The appendix reports mean-flow and linear-stability results. Computations are reported for Stetson's blunt cone at zero angle of attack and Mach 8 and Maslov's blunt cone at Mach 6 In addition, preliminary computations are reported for more complex geometries.

DTIC

Supersonic Combustion Ramjet Engines; Boundary Layer Transition; Hypersonic Speed

20030066935 NASA Dryden Flight Research Center, Edwards, CA, USA

Aeroservoelastic Model Validation and Test Data Analysis of the F/A-18 Active Aeroelastic Wing

Brenner, Martin J.; Prazenica, Richard J.; April 2003; 21 pp.; In English; CEAS/AIAA/NVvL International Forum on Aeroelasticity and Structural Dynamics, 4-6 Jun. 2003, Amsterdam, Netherlands; Original contains black and white illustrations

Contract(s)/Grant(s): WU 710-61-14-SE-14

Report No.(s): NASA/TM-2003-212021; H-2526; NAS 1.15:212021; No Copyright; Avail: CASI; [A03](#), Hardcopy

Model validation and flight test data analysis require careful consideration of the effects of uncertainty, noise, and nonlinearity. Uncertainty prevails in the data analysis techniques and results in a composite model uncertainty from unmodeled dynamics, assumptions and mechanics of the estimation procedures, noise, and nonlinearity. A fundamental requirement for reliable and robust model development is an attempt to account for each of these sources of error, in particular, for model validation, robust stability prediction, and flight control system development. This paper is concerned with data processing procedures for uncertainty reduction in model validation for stability estimation and nonlinear identification. F/A-18 Active Aeroelastic Wing (AAW) aircraft data is used to demonstrate signal representation effects on uncertain model development, stability estimation, and nonlinear identification. Data is decomposed using adaptive orthonormal best-basis and wavelet-basis signal decompositions for signal denoising into linear and nonlinear identification algorithms. Nonlinear identification from a wavelet-based Volterra kernel procedure is used to extract nonlinear dynamics from aeroelastic responses, and to assist model development and uncertainty reduction for model validation and stability prediction by removing a class of nonlinearity from the uncertainty.

Author

Aeroservoelasticity; Flight Control; Flight Tests; F-18 Aircraft; Data Processing; Models

20030067373 Academy of Sciences (USSR), USSR

Theory of Wings in Nonstationary Flow

Nekrasov, A. I.; Bulletin de L'Academie des Sciences de L'URSS; June 1947; 22 pp.; In English

Report No.(s): NACA-TM-1154; No Copyright; Avail: CASI; [A03](#), Hardcopy

This paper gives an overview of equations for vibration and flutter affecting airplane wings in nonstationary flow.

CASI

Wings; Flutter

09

RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems. For airport ground operations see *03 Air Transportation and Safety*. For astronautical facilities see *14 Ground Support Systems and Facilities (Space)*.

20030066323

Evaluation of Runway Preservation System

Shoenberger, James E.; Newman, J. K.; Mar. 2003; 29 pp.; In English

Report No.(s): AD-A412952; ERDC/GSL-SR-03-2; No Copyright; Avail: CASI; [A03](#), Hardcopy

The U.S. Air Force has a large number of bituminous airfield pavements A major concern is increased susceptibility to raveling under traffic as the pavements age. Relative to this is the instance where a seldom-used airfield pavement suddenly receives an increase in traffic as the result of a change in mission requirements Therefore, a material that could be easily and economically applied to aged pavement surfaces, to hold the existing surface structure in place, would be of great value Asphalt Systems Incorporated (ASI) has developed an emulsified bituminous product called Runway Preservation System (RPS) This material is intended as a pavement seal coat material for use on raveling airfield pavements The pavement surface is normally sanded immediately after application of the emulsion The ASI-RPS sealer has been successfully placed on over

60 general aviation airfields since 1990 It has been used at Portland International Airport (PDX), Portland, OR, since 1992 Tests at PDX and other locations have shown that the ASI-RPS does not have an adverse effect on skid resistance. The overall objective of this research effort was to quantify, through field and laboratory testing, the various engineering characteristics required of ASI- RPS to be an effective pavement sealer The specific objective of the proposed work plan was to evaluate the effectiveness of the ASI-RPS as a sealer for airfield pavements on both low- and high-speed areas and its impact on pavement skid resistance

DTIC

Landing Sites; Asphalt; Pavements; Runways; Sealers

12

ASTRONAUTICS (GENERAL)

Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see *categories 13 through 20*. For extraterrestrial exploration see *91 Lunar and Planetary Science and Exploration*.

20030067349 Technische Univ., Delft

Initial Postbuckling Behaviour of Shells of Revolution

Hendriks, P. F.; August 1997; 176 pp.; In English

Report No.(s): PB2003-104790; M-810; Copyright; Avail: National Technical Information Service (NTIS)

Lately a newly developed computer code CALYMERHO was developed to analyze the elastic stability of anisotropic shells of revolution. In this report the effects of (unavoidable) initial geometric imperfections on the buckling behavior of such shells is studied since they can decrease the load carrying capacity seriously. The computational module COMPOSOR (COMputational Module for initial POstbuckling of Shells Of Revolution) was developed based on the theory presented in this report. It uses the results of CALYMERHO to calculate the solution to postbuckling equations and derivatives of the prebuckling state and evaluate the postbuckling coefficients and imperfection form factors. Using this program various shells and loading cases are analyzed and are compared with previous investigators and other computer codes. To investigate the influence of the step-size in the solution-procedure, a convergence study is done for these cases.

NTIS

Buckling; Anisotropic Shells; Elastic Properties

20030067354 Technische Univ., Delft

Active Damping of an Acoustically Loaded Solar Array Panel Using Piezoelectric Sensors and Actuators. A Feasibility Study

Boot, A. H.; Sep. 1997; 210 pp.; In English

Report No.(s): PB2003-104789; M-812; Copyright; Avail: National Technical Information Service (NTIS)

This study is intended to investigate the feasibility of the application of active damping to solar array panels, when using piezoelectric actuators and sensors. The main objective of this study therefore is not to obtain results that closely approximate the real life behavior of a solar array panel, rather, it is intended to determine the upper boundaries of active damping when applied to a solar array panel. On the basis of these results it can then be decided whether active damping is deemed feasible, and if continuation studies are to be conducted. Seeing that the study is mainly intended to determine the feasibility of active control, the employed theory is essentially of a basic mechanical nature, and typical control engineering subjects such as system stability, noise and model robustness are deferred to future studies. Therefore, basic knowledge on mechanical engineering and structural mechanics is recommended.

NTIS

Piezoelectric Actuators; Mechanical Properties; Active Control

20030067520

Solar Thermal Propulsion IHPRPT Demonstration Program

Lester, Dean M.; Wassom, Steven R.; Pearson, James C.; Holmes, Michael R.; Sep. 12, 2000; 12 pp.; In English

Contract(s)/Grant(s): Proj-1011

Report No.(s): AD-A413007; AFRL-PR-ED-TP-2000-177; No Copyright; Avail: CASI; [A03](#), Hardcopy

Spacecraft powered by solar thermal propulsion engines will be able to provide the velocity change required to

economically maneuver large payloads from one orbit to another or to perform interplanetary missions. This innovative concept, when applied, will double the efficiency of currently used LH2 - LO2 chemical upper stages. Solar thermal propulsion uses the sun's energy to heat a low molecular weight working fluid such as hydrogen to very high temperatures (3,000 K). The stored thermal energy is then converted to kinetic energy as the working fluid exits a diverging nozzle.

DTIC

Solar Thermal Propulsion; Spacecraft Propulsion; Rocket Thrust; Kinetic Energy

13 ASTRODYNAMICS

Includes powered and free flight trajectories; orbital and launching dynamics.

20030067287 TRW, Inc., Redondo Beach, CA

The Impact of Tropospheric Rocket Exhaust on Stratospheric Ozone

Prather, Michael J.; May 31, 1994; 39 pp.; In English

Report No.(s): AD-A414325; No Copyright; Avail: CASI; [A03](#), Hardcopy

The relative importance of direct stratospheric injections of chlorine from the Solid Rocket Motors on the Space Shuttle and other spacecraft such as the Titan IV have been assessed previously. The possibility that the tropospheric exhaust (2/3 of the total for the Shuttle SRM) would eventually enter the stratosphere and contribute to ozone depletion has not been evaluated. A three-dimensional chemical transport model is used to simulate the fate of the tropospheric component of the Shuttle exhaust: its dispersion, wet removal in convective events, and possible entrainment into the stratosphere. For any reasonable value for the efficiency of removal in deep, wet, cumulus convection, more than 99.5% of the soluble chlorine injected below 200 mbar is removed in the first three months. The fraction entering the stratosphere is less than 0.2% in both summer and winter seasons. Additional evidence from microphysical models and from analyses of the chlorine budget of the stratosphere argues that soluble chlorine from the troposphere cannot contribute significantly to stratospheric chlorine. In summary, only direct stratospheric injection of chlorine (i.e., fuel burned in the stratosphere) is potentially important; the tropospheric emissions from perchlorate-fueled SRM (e.g., Space Shuttle, Titan IV) are unlikely to impact stratospheric ozone.

DTIC

Troposphere; Chlorine; Stratosphere; Rocket Exhaust; Ozone Depletion

20030067306 Naval Postgraduate School, Monterey, CA

NPSAT1 Attitude Control Subsystem Hardware-in-the-Loop Simulation

Schmidt, Alexander; May 5, 2003; 186 pp.; In English

Report No.(s): AD-A414530; NPS-SP-03-002; No Copyright; Avail: CASI; [A09](#), Hardcopy

NPSAT1 is a three-axis stabilized spacecraft. Its Attitude Control Subsystem (ACS) uses a magnetic control approach that will be used for the first time. The Magnetic control approach is verified with an ACS SIMULINK model of NPSAT1. The correct SIMULINK implementation of the magnetic control algorithm will be verified with an ACS air bearing SIMULINK model and a hardware-embedded ACS control algorithm SIMULINK model that controls the test platform on a spherical air bearing table. This is a report of the work that covers different steps of the air bearing table set-up for these hardware-in-the-loop simulations. The first part describes the approach of determining an air bearing table location in Earth's magnetic field with minimal magnetic deviation to provide good conditions for hardware-in-the-loop simulations. The second part is the attempt of developing custom driver software for the magnetic measurement device that is going to be used on the air bearing test platform. The third part gives some information about the general structure of the hardware-in-the-loop test setup and the hardware setup of the air bearing platform.

DTIC

Computerized Simulation; Artificial Satellites; Control

20030067436 TRW, Inc., Redondo Beach, CA

Summary of the Impact of Launch Vehicle Exhaust and Deorbiting Space and Meteorite Debris on Stratospheric Ozone

Smith, Tyrrel W.; Edwards, John R.; Pilson, Daniel; Sep. 30, 1999; 154 pp.; In English

Contract(s)/Grant(s): F09603-95-D-0176

Report No.(s): AD-A414306; No Copyright; Avail: CASI; [A08](#), Hardcopy

Assessments of the current understanding of the stratospheric ozone layer and its depletion by natural and anthropogenic

sources have been published in various joint reports from the World Meteorological Organization and the United Nations Environment Program. However, the effects of rocket exhaust on stratospheric ozone have not been updated in these assessments since 1991 (WMO 1991), and many questions have been left unanswered. The objective of this report is to compile and present current computer modeling calculations, laboratory data, and in-situ observations on the effects of rocket exhaust on stratospheric ozone. This report also describes the impact of deorbiting debris from satellites and launch vehicles on stratospheric ozone and compares this with the impact of meteorite debris. The information in this document is provided as a record of accomplishments and as a resource, and will serve as the current assessment report on the impact of rocket emissions and debris on stratospheric ozone.

DTIC

Debris; Launch Vehicles; Meteorites; Stratosphere; Ozone Depletion

15

LAUNCH VEHICLES AND LAUNCH OPERATIONS

Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also *18 Spacecraft Design, Testing and Performance*; and *20 Spacecraft Propulsion and Power*.

20030067199 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA

Experimental Investigation of Distributed Attitude Control for Spacecraft Formation Flying

Hall, Christopher; Jan. 20, 2003; 9 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0209

Report No.(s): AD-A413460; AFRL-SR-AR-TR-03-0148; No Copyright; Avail: CASI; [A02](#), Hardcopy

Formation flying missions are continually growing in size and complexity, and the requirement for ground-based demonstration of distributed systems grows with them. However, simulating the on-orbit environment shared by a group of satellites is a difficult task. The primary purpose of this DURIP project was established a Distributed Attitude Control Systems Simulator (DSACSS) in the Space Systems Simulation Laboratory (SSSL) at Virginia Tech. The DSACSS comprises two spherical air bearing spacecraft simulators manufactured by Space Electronics, Inc. in Berlin, CT. One of these simulators was purchased with internal VT funding and the second was purchased as part of this DURIP project. This report describes the state of the art of existing spacecraft simulators, the Distributed Spacecraft Attitude Control System Simulator, as well as several projects that we are undertaking with this unique new facility.

DTIC

Spacecraft; Attitude Control; Spacecraft Control; Systems Simulation; Active Control

20030067521

Environmental Impact Analysis Process, Environmental Assessment Space Test Experiments Platform Mission 3, Vandenberg Air Force Base, CA

Sep. 1994; 100 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F33615-89-D-4003

Report No.(s): AD-A413249; No Copyright; Avail: CASI; [A05](#), Hardcopy

The following environmental areas were assessed for environmental effects in this EA: air quality, global climate change and stratospheric ozone depletion, waste management, energy, space debris, and safety and risk. Air pollutant emissions are minor in quantity, and do not exceed the base aggregate limit. The emissions of greenhouse and ozone-depleting compounds from the proposed action will not significantly increase the atmospheric concentrations of these compounds. Minimal amounts of hazardous and nonhazardous waste will be generated during satellite processing, which can be accommodated by existing VAFB waste management practices. Energy requirements of the STEP M3 are insignificant, and can readily be obtained from local supplies. The probability of personal injury or property damage from space debris is so low that the hazard is taken as part of the accepted risk for the program. Safety and risk concerns were identified in planning for the STEP M3, and safety procedures were incorporated into mission procedures. Final risk levels are considered acceptable. Minor issue areas of noise, public services, utilities, transportation, socioeconomics, hydrology and water quality, natural resources, and visual resources were evaluated in the previous STEP Mission 1 EA, and were found not to be adversely affected. Because the proposed action does not include the construction of any new ground facilities, biological resources, cultural resources, coastal resources, and soils and geology have not been evaluated in this EA. No mitigation measures are required for the proposed action.

DTIC

Air Quality; Environment Effects; Environmental Surveys; Atmospheric Composition; Climate Change

SPACE TRANSPORTATION AND SAFETY

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information see also *03 Air Transportation and Safety*; *15 Launch Vehicles and Launch Operations*; and *18 Spacecraft Design, Testing and Performance*. For space suits see *54 Man/System Technology and Life Support*.

20030066309 NASA Marshall Space Flight Center, Huntsville, AL, USA

Flight Demonstrations of Orbital Space Plane (OSP) Technologies

Turner, Susan; [2003]; 6 pp.; In English; AIAA/ICAS International Air and Space Symposium, 14-18 Jul. 2003, Dayton, OH, USA

Report No.(s): AIAA Paper 2003-2710; No Copyright; Avail: CASI; [A02](#), Hardcopy

The Orbital Space Plane (OSP) Program embodies NASA's priority to transport Space Station crews safely, reliably, and affordably, while it empowers the Nation's greater strategies for scientific exploration and space leadership. As early in the development cycle as possible, the OSP will provide crew rescue capability, offering an emergency ride home from the Space Station, while accommodating astronauts who are deconditioned due to long-duration missions, or those that may be ill or injured. As the OSP Program develops a fully integrated system, it will use existing technologies and employ computer modeling and simulation. Select flight demonstrator projects will provide valuable data on launch, orbital, reentry, and landing conditions to validate thermal protection systems, autonomous operations, and other advancements, especially those related to crew safety and survival.

Author

Aerospace Vehicles; X-37 Vehicle; Space Transportation System

20030066313 NASA Marshall Space Flight Center, Huntsville, AL, USA

Restraining Loose Equipment Aboard the International Space Station: The Payload Equipment Restraint System

Smith Kenneth A.; Reynolds, David W.; [2003]; 6 pp.; In English; 2003 International Conference on Environmental Systems, 7-10 Jul. 2003, Vancouver, British Columbia, Canada

Report No.(s): SAE-03ICES-312; Copyright; Avail: CASI; [A02](#), Hardcopy

As the International Space Station (ISS) grows, so do the supplies and equipment needed to support its daily operations. Each day many items must be unstowed and moved to various worksites so that they are readily available to the crew. Due to the lack of gravity, these items may become loose and float away if not restrained. The Payload Equipment Restraint System (PERS) was developed to meet the new and unique challenge of restraining loose equipment aboard the ISS.

Author

Constraints; Payloads; International Space Station

SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance*; *39 Structural Mechanics*; and *16 Space Transportation and Safety*.

20030066233 NASA Langley Research Center, Hampton, VA, USA

Aeroheating Thermal Model Correlation for Mars Global Surveyor (MGS) Solar Array

Amundsen, Ruth M.; Dec, John A.; George, Benjamin E.; [2003]; 12 pp.; In English; 36th AIAA Thermophysics Conference, 23-26 Jun. 2003, Orlando, FL, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2003-3765; No Copyright; Avail: CASI; [A03](#), Hardcopy

The Mars Global Surveyor (MGS) Spacecraft made use of aerobraking to gradually reduce its orbit period from a highly elliptical insertion orbit to its final science orbit. Aerobraking produces a high heat load on the solar arrays, which have a large surface area exposed to the airflow and relatively low mass. To accurately model the complex behavior during aerobraking, the thermal analysis needed to be tightly coupled to the spatially varying, time dependent aerodynamic heating. Also, the thermal model itself needed to accurately capture the behavior of the solar array and its response to changing heat load conditions. The correlation of the thermal model to flight data allowed a validation of the modeling process, as well as information on what processes dominate the thermal behavior. Correlation in this case primarily involved detailing the thermal sensor nodes, using as-built mass to modify material property estimates, refining solar cell assembly properties, and adding

detail to radiation and heat flux boundary conditions. This paper describes the methods used to develop finite element thermal models of the MGS solar array and the correlation of the thermal model to flight data from the spacecraft drag passes. Correlation was made to data from four flight thermal sensors over three of the early drag passes. Good correlation of the model was achieved, with a maximum difference between the predicted model maximum and the observed flight maximum temperature of less than 5%. Lessons learned in the correlation of this model assisted in validating a similar model and method used for the Mars Odyssey solar array aeroheating analysis, which were used during onorbit operations.

Author

Mars Global Surveyor; Aerobraking; Thermal Analysis

20030066311 NASA Marshall Space Flight Center, Huntsville, AL, USA

Stage Separation Wind Tunnel Tests of a Generic Two-Stage-to-Orbit Launch Vehicle

Bordelon, Wayne J., Jr.; Frost, Alonzo L.; Reed, Darren K.; [2003]; 11 pp.; In English; 21st AIAA Applied Aerodynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA

Report No.(s): AIAA Paper 2003-4227; No Copyright; Avail: CASI; [A03](#), Hardcopy

In support of NASA's Space Launch Initiative Program, stage separation wind tunnel tests of a generic two-stage-to-orbit (TSTO) launch vehicle were conducted to determine the interference aerodynamic forces and moments and to determine the proximity flow environment. The tests were conducted in the NASA Marshall Space Flight Center's Aerodynamic Research Facility using a manual separation fixture for a Mach number range of 2.74 to 4.96 and separation distances up to 80 percent and 35 percent of the body length in the vehicle X and Z coordinates, respectively. For the TSTO bimese, winged-body vehicle configuration, both wing-to-wing and wing-to-fuselage configurations were tested. Individual-body force and moment, schlieren, and surface pressure data were acquired. The results showed that the proximity aerodynamics were dominated by complex bow shock interactions, and that the booster was statically unstable at several separation positions. As compared to the isolated body, the proximity normal force change with pitch angle was found to be nearly the same, and the proximity axial force increased, in general, by 3% for both bodies.

Author

Aerodynamic Forces; Launch Vehicles; Wind Tunnel Tests; Spacecraft Launching; Shock Wave Interaction; Aerodynamic Configurations

20030066328 Lockheed Martin Michoud Space Systems, New Orleans, LA, USA

Composite Development and Applications for RLV Tankage

Wright, Richard J.; Achary, David C.; McBain, Michael C.; [2003]; 20 pp.; In English; AIAA/ICAS International Air and Space Symposium and Exposition, 14-17 Jul. 2003, Dayton, OH, USA

Contract(s)/Grant(s): NCC8-191; No Copyright; Avail: CASI; [A03](#), Hardcopy

The development of polymer composite cryogenic tanks is a critical step in creating the next generation of launch vehicles. Future launch vehicles need to minimize the gross liftoff weight (GLOW), which is possible due to the 28%-41% reduction in weight that composite materials can provide over current aluminum technology. The development of composite cryogenic tanks, feedlines, and unpressurized structures are key enabling technologies for performance and cost enhancements for Reusable Launch Vehicles (RLVs). The technology development of composite tanks has provided direct and applicable data for feedlines, unpressurized structures, material compatibility, and cryogenic fluid containment for highly loaded complex structures and interfaces. All three types of structure have similar material systems, processing parameters, scaling issues, analysis methodologies, NDE development, damage tolerance, and repair scenarios. Composite cryogenic tankage is the most complex of the 3 areas and provides the largest breakthrough in technology. A building block approach has been employed to bring this family of difficult technologies to maturity. This approach has built up composite materials, processes, design, analysis and test methods technology through a series of composite test programs beginning with the NASP program to meet aggressive performance goals for reusable launch vehicles. In this paper, the development and application of advanced composites for RLV use is described.

Author

Reusable Launch Vehicles; Composite Materials; Tanks (Containers); Cryogenics

20030066392 NASA Marshall Space Flight Center, Huntsville, AL, USA

An Integrated Approach to Thermal Management of International Space Station Logistics Flights, Improving the Efficiency

Holladay, Jon; Day, Greg; Roberts, Barry; Leahy, Frank; [2003]; 1 pp.; In English; 33rd International Conference on Environmental Systems, 7-10 Jul. 2003, Vancouver, British Columbia, Canada; No Copyright; Avail: Other Sources; Abstract Only

The efficiency of re-useable aerospace systems requires a focus on the total operations process rather than just orbital performance. For the Multi-Purpose Logistics Module this activity included special attention to terrestrial conditions both pre-launch and post-landing and how they inter-relate to the mission profile. Several of the efficiencies implemented for the MPLM Mission Engineering were NASA firsts and all served to improve the overall operations activities. This paper will provide an explanation of how various issues were addressed and the resulting solutions. Topics range from statistical analysis of over 30 years of atmospheric data at the launch and landing site to a new approach for operations with the Shuttle Carrier Aircraft. In each situation the goal was to 'tune' the thermal management of the overall flight system for minimizing requirement risk while optimizing power and energy performance.

Author

Aerospace Systems; Temperature Control; International Space Station; Logistics; Statistical Analysis

20030066421 NASA Marshall Space Flight Center, Huntsville, AL, USA

The International Space Station's Multi-Purpose Logistics Module, Thermal Performance of the First Five Flights

Holladay, Jon; Cho, Frank; [2003]; 1 pp.; In English; 33rd International Conference on Environmental Systems, 7-10 Jul. 2003, Vancouver, British Columbia, Canada; No Copyright; Avail: CASI; [A01](#), Hardcopy

The Multi-Purpose Logistics Module is the primary carrier for transport of pressurized payload to the International Space Station. Performing five missions within a thirteen month span provided a unique opportunity to gather a great deal of information toward understanding and verifying the orbital performance of the vehicle. This paper will provide a brief overview of the hardware history and design capabilities followed by a summary of the missions flown, resource requirements and possibilities for the future.

Author

International Space Station; Logistics; Payloads; Temperature Effects

20030066435 NASA Marshall Space Flight Center, Huntsville, AL, USA

Cabin Air Quality Dynamics On Board the International Space Station

Perry, J. L.; Peterson, B. V.; [2003]; 9 pp.; In English; 33rd International Conference on Environmental Systems, 7-10 Jul. 2003, Vancouver, British Columbia, Canada

Report No.(s): SAE-2003-01-2650; Copyright; Avail: CASI; [A02](#), Hardcopy

Spacecraft cabin air quality is influenced by a variety of factors. Beyond normal equipment offgassing and crew metabolic loads, the vehicle's operational configuration contributes significantly to overall air quality. Leaks from system equipment and payload facilities, operational status of the atmospheric scrubbing systems, and the introduction of new equipment and modules to the vehicle all influence air quality. The dynamics associated with changes in the International Space Station's (ISS) configuration since the launch of the U.S. Segment's laboratory module, Destiny, is summarized. Key classes of trace chemical contaminants that are important to crew health and equipment performance are emphasized. The temporary effects associated with attaching each multi-purpose logistics module (MPLM) to the ISS and influence of in-flight air quality on the post-flight ground processing of the MPLM are explored.

Author

Spacecraft Cabins; Offgassing; Air Quality; Trace Contaminants; Atmospheric Circulation

20030066438 Smithsonian Astrophysical Observatory, Cambridge, MA, USA

The Propulsive Small Expendable Deployer System (ProSEDS)

Lorenzini, Enrico C.; Cosmo, Mario L.; Curtis, Leslie, Technical Monitor; August 2003; 18 pp.; In English

Contract(s)/Grant(s): NAG8-1605; No Copyright; Avail: CASI; [A03](#), Hardcopy

The summary of activity during this reporting period, most of which was covered by a no-cost extension of the grant, is as follows: 1) Participation in remote and in-situ (at MSFC EDAC facility) mission operation simulations; 2) Analysis of the decay rate of ProSEDS when starting the mission at a lower altitude; 3) Analysis of the deployment control law performance when deploying at a lower altitude.

Derived from text

Space Missions; Deployment; Control Theory

20030066933 NASA Marshall Space Flight Center, Huntsville, AL, USA

Development Status of the International Space Station Urine Processor Assembly

Holder, Donald W.; Hutchens, Cindy F.; [2003]; 13 pp.; In English; 33rd International Conference on Environmental Conference on Environmental Systems, 7-11 Jul. 2003, Vancouver, BC, Canada; Original contains black and white illustrations

Report No.(s): SAE Paper 2003-01-2690; Copyright; Avail: CASI; [A03](#), Hardcopy

NASA, Marshall Space Flight Center (MSFC) is developing a Urine Processor Assembly (UPA) for the International Space Station (ISS). The UPA uses Vapor Compression Distillation (VCD) technology to reclaim water from pre-treated urine. This water is further processed by the Water Processor Assembly (WPA) to potable quality standards for use on the ISS. NASA has developed this technology over the last 25-30 years. Over this history, many technical issues were solved with thousands of hours of ground testing that demonstrate the ability of the UPA technology to reclaim water from urine. In recent years, NASA MSFC has been responsible for taking the UPA technology to 'flight design' maturity. This paper will give a brief overview of the UPA design and a status of the major design and development efforts completed recently to mature the UPA to a flight level.

Author

Urine; International Space Station; Distillation; Ground Tests

20030067398 NASA Ames Research Center, Moffett Field, CA, USA

Evolutionary Design of an X-Band Antenna for NASA's Space Technology 5 Mission

Lohn, Jason D.; Hornby, Gregory S.; Rodriguez-Arroyo, Adan; Linden, Derek S.; Kraus, William F.; Seufert, Stephen E.; [2003]; 9 pp.; In English; 2003 NASA/DoD Conference on Evolvable Hardware, 2003; Original contains black and white illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy

We present an evolved X-band antenna design and flight prototype currently on schedule to be deployed on NASA's Space Technology 5 spacecraft in 2004. The mission consists of three small satellites that will take science measurements in Earth's magnetosphere. The antenna was evolved to meet a challenging set of mission requirements, most notably the combination of wide beamwidth for a circularly-polarized wave and wide bandwidth. Two genetic algorithms were used: one allowed branching in the antenna arms and the other did not. The highest performance antennas from both algorithms were fabricated and tested. A hand-designed antenna was produced by the contractor responsible for the design and build of the mission antennas. The hand-designed antenna is a quadrifilar helix, and we present performance data for comparison to the evolved antennas. As of this writing, one of our evolved antenna prototypes is undergoing flight qualification testing. If successful, the resulting antenna would represent the first evolved hardware in space, and the first deployed evolved antenna.

Author

NASA Space Programs; Aerospace Engineering; Antenna Design; Superhigh Frequencies; Fabrication; Space Missions

20030067582 Northrop Grumman Corp., Redondo, CA, USA, NASA Marshall Space Flight Center, Huntsville, AL, USA

Design and Testing of Non-Toxic RCS Thrusters for Second Generation Reusable Launch Vehicle

Calvignac, Jacky; Dang, Lisa; Tramel, Terri; Passeur, Lila; Champion, Robert, Technical Monitor; July 22, 2003; 13 pp.; In English; 39th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 20-23 Jul. 2003, Huntsville, AL, USA

Contract(s)/Grant(s): NAS8-01110; NAG8-0110

Report No.(s): AIAA Paper 2003-4922; Copyright; Avail: CASI; [A03](#), Hardcopy

Under NASA sponsorship, Northrop Grumman Space Technology (NGST) designed, built and tested two non-toxic, reaction control engines, one using liquid oxygen (LOX) and liquid hydrogen (LH2) and the other using liquid oxygen and ethanol. This paper presents the design and testing of the LOX/LH2 thruster. The two key enabling technologies are the coaxial liquid-on-liquid pintle injector and the fuelcooling duct. The workhorse thruster was hotfire tested at the NASA Marshall Space Flight Center Test Stand 500 in March and April of 2002. All tests were performed at sea-level conditions. During the test program, 7 configurations were tested, including 2 combustion chambers, 3 LOX injector pintle tips, and 4 LH2 injector settings. The operating conditions surveyed were 70 to 100% thrust levels, mixture ratios from 3.27 to 4.29, and LH2 duct cooling from 18.0 to 25.5% fuel flow. The copper heat sink chamber was used for 16 burns, each burn lasting from 0.4 to 10 seconds, totaling 51.4 seconds, followed by Haynes chamber testing ranging from 0.9 to 120 seconds, totaling 300.9 seconds. The performance of the engine reached 95% C* efficiency. The temperature on the Haynes chamber remained well below established material limits, with the exception of one localized hot spot. These results demonstrate that both the coaxial liquid-on-liquid pintle injector design and fuel duct concepts are viable for the intended application. The thruster headend design maintained cryogenic injection temperatures while firing, which validates the selected injector design approach for minimal heat soak-back. Also, off-nominal operation without adversely impacting the thermal response of the engine showed

the robustness of the duct design, a key design feature for this application. By injecting fuel into the duct, the throat temperatures are manageable, yet the split of fuel through the cooling duct does not compromise the overall combustion efficiency, which indicates that, provided proper design refinement, such a concept could be applied to a high-performance version of the thruster.

Author

Aerospace Engineering; Reusable Launch Vehicles; Engine Tests; Combustion Chambers; Combustion Efficiency; Spacecraft Performance; Thrust

19

SPACECRAFT INSTRUMENTATION AND ASTRIONICS

Includes the design, manufacture, or use of devices for the purpose of measuring, detecting, controlling, computing, recording, or processing data related to the operation of space vehicles or platforms. For related information see also *06 Avionics and Aircraft Instrumentation*; for spaceborne instruments not integral to the vehicle itself see *35 Instrumentation and Photography*; for spaceborne telescopes and other astronomical instruments see *89 Astronomy*.

20030066367 Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil

A Study of an Active Precession Control System (SCAP) for Sounding Rockets

Guilherme, Michel Silas; 2003; 152 pp.; In Portuguese; CD-ROM contains full text document in PDF format and color illustrations. PDF also has blank pages.

Report No.(s): INPE-9780-TDI/862; Copyright; Avail: CASI; [C01](#), CD-ROM; [A08](#), Hardcopy

During the flight of a spacecraft there will be various sources of perturbations, where the most expressive are jet misalignment, dynamic unbalance, stages separation, that induce a precession motion, in spite of the spin stabilization. This motion, whose amplitude is proportional to the magnitude of the perturbation, can become catastrophic, ultimately leading to mission abort. To ensure that the precession motion remains within prescribed limits a control law proportional to the angular velocities in the body frame was proposed. A control system of one and two axes was studied. On the one axis control system the strategy of misalignment between sensor and actuators was studied. This strategy implies in reducing the number of sensors and actuators of the control system. It was observed that the angle is sensible to the spin and disturbance orientation. Finally, a control system with an on-off actuator was studied. It shown to be very satisfactory, in respect to the amplitude of the precession motion and control torque, and present advantages in comparison with the control system with proportional actuator.

Author

Active Control; Sounding Rockets; Precession

20030066440 Nauchno-Proizvodstvennoe Obedinenie Prikladnoi Mekhaniki, Krasnoyarsk, Russia

Hall Effect Thruster Interactions Data From the Russian Express-A2 and Express-A3 Satellites, Part 2, Acquire TM Date for Type B Sensors for 'Express-A' Number 2 Satellite for the Period of March 12, 2000 to and Including June 15, 2000, Task 25

Dunning, John, Technical Monitor; Sitnikova, N.; Volkov, D.; Maximov, I.; Petrusevich, V.; Allen, D.; June 2003; 162 pp.; In English

Contract(s)/Grant(s): NAS3-99151; NAS3-99204; WBS 22-800-91-01

Report No.(s): NASA/CR-2003-212005/PT2; E-13691-2/PT2; NAS 1.15:212005/PT2; No Copyright; Avail: CASI; [A08](#), Hardcopy

This 12-part report documents the data obtained from various sensor measurements taken aboard the Russian Express-A2 and Express-A3 spacecraft in Geosynchronous Earth Orbit (GEO). These GEO communications satellites, which were designed and built by NPO Prikladnoy Mekhaniki (NPO PM) of Zheleznogorsk, Russia, utilize Hall thruster propulsion systems for north-south and east-west stationkeeping and as of June 2002, were still operating at 80 E. and 11 W., respectively. Express-A2 was launched on March 12, 2000, while Express-A3 was launched on June 24, 2000. The diagnostic equipment from which these data were taken includes electric field strength sensors, ion current and energy sensors, and pressure sensors. The diagnostics and the Hall thruster propulsion systems are described in detail along with lists of tabular data from those diagnostics and propulsion system and other satellite systems. Space Power, Inc., now part of Pratt & Whitney's Chemical Systems Division, under contract NAS3 99151 to the NASA Glenn Research Center, obtained these data over several periods from March 12, 2000, through September 30, 2001. Each of the 12 individual reports describe, in detail, the propulsion

systems as well as the diagnostic sensors utilized. Finally, parts 11 and 12 include the requirements to which NPO PM prepared and delivered these data.

Author

Hall Thrusters; Communication Satellites; Geosynchronous Orbits; Propulsion System Configurations

20030066757 Arizona Univ., Tucson, AZ, USA, Ball Aerospace and Technologies Corp., Boulder, CO, USA

MRO High Resolution Imaging Science Experiment (HiRISE): Instrument Development

Delamere, Alan; Becker, Ira; Bergstrom, Jim; Burkepile, Jon; Day, Joe; Dorn, David; Gallagher, Dennis; Hamp, Charlie; Lasco, Jeffrey; Meiers, Bill, et al.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS7-1407; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The primary functional requirement of the HiRISE imager is to allow identification of both predicted and unknown features on the surface of Mars to a much finer resolution and contrast than previously possible. This results in a camera with a very wide swath width, 6km at 300km altitude, and a high signal to noise ratio, >100:1. Generation of terrain maps, 30 cm vertical resolution, from stereo images requires very accurate geometric calibration. The project limitations of mass, cost and schedule make the development challenging. In addition, the spacecraft stability must not be a major limitation to image quality. The nominal orbit for the science phase of the mission is a 3pm orbit of 255 by 320 km with periapsis locked to the south pole. The track velocity is approximately 3,400 m/s.

Author

Imaging Techniques; Mars Surface; Planetary Mapping; Spacecraft Instruments; Cameras

20030066758 California Univ., Berkeley, CA, USA

The Design and Implementation of Instruments for Low-Frequency Electromagnetic Sounding of the Martian Subsurface

Delory, G. T.; Grimm, R. E.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations

Contract(s)/Grant(s): NAG5-11781; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Low-frequency electromagnetic soundings of the subsurface can identify liquid water at depths ranging from hundreds of meters to approx. 10 km in an environment such as Mars. Among the tools necessary to perform these soundings are low-frequency electric and magnetic field sensors capable of being deployed from a lander or rover such that horizontal and vertical components of the fields can be measured free of structural or electrical interference. Under a NASA Planetary Instrument Definition and Development Program (PIDDP), we are currently engaged in the prototype stages of low frequency sensor implementations that will enable this technique to be performed autonomously within the constraints of a lander platform. Once developed, this technique will represent both a complementary and alternative method to orbital radar sounding investigations, as the latter may not be able to identify subsurface water without significant ambiguities. Low frequency EM methods can play a crucial role as a ground truth measurement, performing deep soundings at sites identified as high priority areas by orbital radars. Alternatively, the penetration depth and conductivity discrimination of low-frequency methods may enable detection of subsurface water in areas that render radar methods ineffective. In either case, the sensitivity and depth of penetration inherent in low frequency EM exploration makes this tool a compelling candidate method to identify subsurface liquid water from a landed platform on Mars or other targets of interest.

Author

Spacecraft Instruments; Ground Water; Mars Surface; Sounding

SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information see also *07 Aircraft Propulsion and Power*, *28 Propellants and Fuels*, *15 Launch Vehicles and Launch Operations*, and *44 Energy Production and Conversion*.

20030066235 Science Applications International Corp., Huntsville, AL, USA

The Electric Propulsion Interactions Code (EPIC): A Member of the NASA Space Environment and Effects Program (SEE) Toolset

Mikellides, Ioannis G.; Mandell, Myron J.; Kuharski, Robert A.; Davis, D. A.; Gardner, Barbara M.; Minor, Jody; July 20, 2003; 13 pp.; In English; AIAA Joint Propulsion Conference, 20-23 Jul. 2003, Huntsville, AL, USA

Contract(s)/Grant(s): NAS8-02028

Report No.(s): AIAA Paper 2003-4871; Copyright; Avail: CASI; [A03](#), Hardcopy

Science Applications International Corporation is currently developing the Electric Propulsion Interactions Code, EPIC, as part of a project sponsored by the Space Environments and Effects Program at NASA Marshall Space Flight Center. Now in its second year of development, EPIC is an interactive computer toolset that allows the construction of a 3-D spacecraft model, and the assessment of a variety of interactions between its subsystems and the plume from an electric thruster. This paper reports on the progress of EPIC including the recently added ability to exchange results the NASA Charging Analyzer Program, Nascap-2k. The capability greatly enhances EPIC's range of applicability. Expansion of the toolset's various physics models proceeds in parallel with the overall development of the software. Also presented are recent upgrades of the elastic scattering algorithm in the electric propulsion Plume Tool. These upgrades are motivated by the need to assess the effects of elastically scattered ions on the SIC for ion beam energies that exceed 100 eV. Such energy levels are expected in future high-power (>10 kW) ion propulsion systems empowered by nuclear sources.

Author

Electric Propulsion; Propulsion System Configurations; Plumes; Propulsion System Performance

20030066236 Alabama Univ., Birmingham, AL, USA

Development of Efficient Real-Fluid Model in Simulating Liquid Rocket Injector Flows

Cheng, Gary; Farmer, Richard; July 2003; 11 pp.; In English; AIAA Joint Propulsion Conference, Jul. 2003, Huntsville, AL, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NAS8-02062; Copyright; Avail: CASI; [A03](#), Hardcopy

The characteristics of propellant mixing near the injector have a profound effect on the liquid rocket engine performance. However, the flow features near the injector of liquid rocket engines are extremely complicated, for example supercritical-pressure spray, turbulent mixing, and chemical reactions are present. Previously, a homogeneous spray approach with a real-fluid property model was developed to account for the compressibility and evaporation effects such that thermodynamics properties of a mixture at a wide range of pressures and temperatures can be properly calculated, including liquid-phase, gas-phase, two-phase, and dense fluid regions. The developed homogeneous spray model demonstrated a good success in simulating uni-element shear coaxial injector spray combustion flows. However, the real-fluid model suffered a computational deficiency when applied to a pressure-based computational fluid dynamics (CFD) code. The deficiency is caused by the pressure and enthalpy being the independent variables in the solution procedure of a pressure-based code, whereas the real-fluid model utilizes density and temperature as independent variables. The objective of the present research work is to improve the computational efficiency of the real-fluid property model in computing thermal properties. The proposed approach is called an efficient real-fluid model, and the improvement of computational efficiency is achieved by using a combination of a liquid species and a gaseous species to represent a real-fluid species.

Author

Injectors; Liquid Propellant Rocket Engines; Liquid Flow; Computational Fluid Dynamics; Supercritical Pressures; Compressibility Effects; Chemical Reactions

20030066238 Science Applications International Corp., USA

Optimization of Brayton Cycle Power Generation for In-Space Electric Propulsion Application

Woodcock, Gordon; [2003]; 9 pp.; In English; 39th Joint Propulsion Conference and Exhibit, 20-23 Jul. 2003, Huntsville, AL, USA

Contract(s)/Grant(s): NASA Order H-35186-D; Copyright; Avail: CASI; [A02](#), Hardcopy

A Brayton cycle was analyzed and optimized over the power range 60 - 140 kW, for application to electric propulsion

systems. A gas-cooled reactor heat source with exit temperature 1150 K was assumed. Power generation system specific masses (alpha) from 36 kg/kWe at 60 kWe to 22 kg/kWe at 140 kWe were obtained. These masses do not include the thrust production system, which is predicted to add 6 to 8 kg/kWe. Cycle efficiencies varied from 32% at 60 kWe to 36% at 140 kWe. Cycle minimum temperature, cycle pressure ratio, and heat exchanger design parameters were varied for the optimization. Optimization parameters and methods are described.

Author

Electric Propulsion; Brayton Cycle; Propulsion System Configurations; Propulsion System Performance

20030066245 ATK-Thiokol Propulsion, Brigham City, UT, USA

Development of Displacement Gages Exposed to Solid Rocket Motor Internal Environments

Bolton, D. E.; Cook, D. J.; [2003]; 12 pp.; In English; 39th AIAA/ASME/SAWASEE Joint Propulsion Conference, 20-23 Jul. 2003, Huntsville, AL, USA

Contract(s)/Grant(s): NAS8-9723

Report No.(s): AIAA Paper 2003-5106; Copyright; Avail: CASI; [A03](#), Hardcopy

The Space Shuttle Reusable Solid Rocket Motor (RSRM) has three non-vented segment-to-segment case field joints. These joints use an interference fit J-joint that is bonded at assembly with a Pressure Sensitive Adhesive (PSA) inboard of redundant O-ring seals. Full-scale motor and sub-scale test article experience has shown that the ability to preclude gas leakage past the J-joint is a function of PSA type, joint moisture from pre-assembly humidity exposure, and the magnitude of joint displacement during motor operation. To more accurately determine the axial displacements at the J-joints, two thermally durable displacement gages (one mechanical and one electrical) were designed and developed. The mechanical displacement gage concept was generated first as a non-electrical, self-contained gage to capture the maximum magnitude of the J-joint motion. When it became feasible, the electrical displacement gage concept was generated second as a real-time linear displacement gage. Both of these gages were refined in development testing that included hot internal solid rocket motor environments and simulated vibration environments. As a result of this gage development effort, joint motions have been measured in static fired RSRM J-joints where intentional venting was produced (Flight Support Motor #8, FSM-8) and nominal non-vented behavior occurred (FSM-9 and FSM-10). This data gives new insight into the nominal characteristics of the three case J-joint positions (forward, center and aft) and characteristics of some case J-joints that became vented during motor operation. The data supports previous structural model predictions. These gages will also be useful in evaluating J-joint motion differences in a five-segment Space Shuttle solid rocket motor.

Author

Solid Propellant Rocket Engines; Seals (Stoppers); O Ring Seals; Full Scale Tests; Durability; Interference Fit

20030066294 NASA Marshall Space Flight Center, Huntsville, AL, USA

Space Shuttle Main Engine Inlet Fluctuating Pressure Environment for the Liner Crack Investigation

Zoladz, Thomas F.; Nesman, Tomas E.; [2003]; 15 pp.; In English; 39th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 20-23 Jul. 2003, Huntsville, AL, USA

Report No.(s): AIAA Paper 2003-5068; Copyright; Avail: Other Sources

In the summer of 2002, small cracks were found in the liquid hydrogen feedlines of several Space Shuttle Orbiters. During the ensuing investigation, the unsteady flow environment surrounding the cracked liner less than a foot upstream of the shuttle main engine low pressure fuel pump was characterized extensively. The engine fuel inlet fluctuating pressure environment established from highly instrumented single-engine hotfire tests both with and without a flow liner simulator are described. Cavitation induced oscillation phenomena common in the inlet region of high-speed rocket engine turbopumps were mapped as well as fluid-resonant liner edge-tones. Correlation of the dynamically rich measured fluctuating pressure fields to dynamic liner strains are discussed.

Author

Cracks; Space Shuttle Main Engine; Cavitation Flow; Feed Systems; Pressure Distribution; Rocket Engines; Unsteady Flow

20030066361 NASA Marshall Space Flight Center, Huntsville, AL, USA

Full-and Partial-Admission Performance of the Simplex Turbine

Dorney, Daniel J.; Griffin, Lisa W.; Sondak, Douglas L.; [2003]; ISSN 0748-4658; 6 pp.; In English; Copyright; Avail: Other Sources

The turbines used in rocket-engine applications are often partial-admission turbines, meaning that the flow enters the rotor over only a portion of the annulus. These turbines have been traditionally analyzed, however, assuming full-admission

characteristics. This assumption enables the simulation of only a portion of the 360-deg annulus with periodic boundary conditions applied in the circumferential direction. Whereas this traditional approach to simulating the flow in partial-admission turbines significantly reduces the computational requirements, the accuracy of the solutions has not been evaluated or compared to partial-admission data. In the current investigation, both full-admission and partial-admission three-dimensional unsteady Navier-Stokes simulations were performed for a partial-admission turbine designed and tested at NASA Marshall Space Flight Center. The results indicate that the partial-admission nature of the turbine should be included in simulations to properly predict the performance and flow unsteadiness of the turbine.

Author

Navier-Stokes Equation; Supersonic Turbines

20030066364 Aerojet-General Corp., Sacramento, CA, USA

Monolithic Hydrogen Peroxide Catalyst Bed Development

Ponzo, J. B.; [2003]; 8 pp.; In English; 39th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 20-23 Jul. 2003, Huntsville, AL, USA

Contract(s)/Grant(s): NAS8-02001; No Copyright; Avail: CASI; [A02](#), Hardcopy

With recent increased industry and government interest in rocket grade hydrogen peroxide as a viable propellant, significant effort has been expended to improve on earlier developments. This effort has been predominately centered in improving heterogeneous, typically catalyst beds; and homogeneous catalysts, which are typically solutions of catalytic substances. Heterogeneous catalyst beds have traditionally consisted of compressed wire screens plated with a catalytic substance, usually silver, and were used in many RCS applications (X-1, Mercury, and Centaur for example). Aerojet has devised a heterogeneous catalyst design that is monolithic (single piece), extremely compact, and has pressure drops equal to or less than traditional screen beds. The design consists of a bonded stack of very thin, photoetched metal plates, silver coated. This design leads to a high surface area per unit volume and precise flow area, resulting in high, stable, and repeatable performance. Very high throughputs have been demonstrated with 90% hydrogen peroxide. (0.60 lbm/s/sq in at 1775-175 psia) with no flooding of the catalyst bed. Bed life of over 900 seconds has also been demonstrated at throughputs of 0.60 lbm/s/sq in across varying chamber pressures. The monolithic design also exhibits good starting performance, short break-in periods, and will easily scale to various sizes.

Author

Hydrogen Peroxide; Catalysts; Heterogeneity; Rocket Propellants

20030066370 NASA Marshall Space Flight Center, Huntsville, AL, USA

Experimental Blade Surface Pressures of a Supersonic Turbine for Rocket Engine Applications

Zoladz, Thomas F.; Griffin, Lisa W.; Dorney, Daniel J.; [2003]; 15 pp.; In English; 39th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 20-23 Jul. 2003, Huntsville, AL, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2003-4916; Copyright; Avail: Other Sources

Understanding the unsteady aspects of rotor flow fields is critical to the successful design of rocket engine turbines. A technology program is currently being conducted at NASA's Marshall Space Flight Center to increase the understanding of unsteady environments for a supersonic turbine. The experimental portion of the program involves the instrumenting of supersonic rotor blades with miniature high frequency response pressure transducers. Great detail has been taken in optimizing the accuracy of the of the pressure transducers. The accuracy of the current experimental effort has greatly improved relative to prior turbine environment mapping efforts. Time-averaged and unsteady blade surface pressure distributions are compared to computations derived from a three-dimensional Navier-Stokes analysis also performed for the technology program. The results comprise the first known surface pressure data set from a highly instrumented supersonic rotor.

Author

Pressure Distribution; Supersonic Turbines; Pressure Sensors; Flow Distribution

20030066431 NASA Marshall Space Flight Center, Huntsville, AL, USA

Quasi-One-Dimensional Modeling of Pulse Detonation Rocket Engines

Morris, Christopher I.; [2002]; 3 pp.; In English; 39th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 20-23 Jul. 2003, Huntsville, AL, USA; No Copyright; Avail: CASI; [A01](#), Hardcopy

Pulsed detonation rocket engines (PDREs) have generated considerable research interest in recent years as a chemical propulsion system potentially offering improved performance and reduced complexity compared to conventional rocket engines. The detonative mode of combustion employed by these devices offers a thermodynamic advantage over the

constant-pressure deflagrative combustion mode used in conventional rocket engines and gas turbines. However, while this theoretical advantage has spurred a great deal of interest in building PDRE devices, the unsteady blowdown process intrinsic to the PDRE has made realistic estimates of the actual propulsive performance problematic. The recent review article by Kailasanath highlights some of the difficulties in comparing the available experimental measurements with numerical models. In a previous paper by the author, parametric studies of the performance of a single, straight-tube PDRE were reported. A 1-D, unsteady method of characteristics code, employing a constant-gamma assumption behind the detonation front, was developed for that study. Models of this type are computationally inexpensive, and are particularly useful for parametric performance comparisons. For example, a plot showing the specific impulse of various PDRE and steady-state rocket engine (SSRE) configurations as a function of blowdown pressure ratio. The performance curves clearly indicate that a straight-tube PDRE is superior in specific impulse to a SSRE with a sonic nozzle over the entire range of pressure ratios. Note, however, that a straight-tube PDRE in general does not compare favorably to a SSRE fitted with an optimized de Laval supersonic nozzle, particularly at the high pressure ratios typical for boost or in-space rocket applications. However, the calculations also show that if a dynamically optimized, supersonic de Laval nozzle could be fitted to a PDRE, then the specific impulse of the device would exceed that of a comparable SSRE. While such a nozzle is a considerable idealization, it is clear that nozzle design and optimization will play a critical role in whether the performance potential of PDREs can be effectively realized in practice. In order to study PDRE nozzle issues with greater accuracy, a quasi-one-dimensional, finite-rate chemistry CFD code has been developed by the author. Comparisons of the code with both the previous MOC model and experimental data from Stanford University are reported. The effect of constant-gamma and finite-rate chemistry assumptions on the flowfield and performance is examined. Parametric studies of the effect of nozzle throat size and expansion ratio, at various blowdown pressure ratios, are reported.

Author

Pulse Detonation Engines; Chemical Propulsion; Thermodynamics; Design Optimization; Nozzle Design

20030066437 NASA Marshall Space Flight Center, Huntsville, AL, USA

Plasma Interactions with High Voltage Solar Arrays for a Direct Drive Hall Effect Thruster System

Schneider, T.; Horvater, M. A.; Vaughn, J.; Carruth, M. R.; Jongeward, G. A.; Mikellides, I. G.; [2003]; 1 pp.; In English; AIAA 2003 Joint Propulsion Conference, 20-23 Jul. 2003, Huntsville, AL, USA; Copyright; Avail: Other Sources; Abstract Only

The Environmental Effects Group of NASA's Marshall Space Flight Center (MSFC) is conducting research into the effects of plasma interaction with high voltage solar arrays. These high voltage solar arrays are being developed for a direct drive Hall Effect Thruster propulsion system. A direct drive system configuration will reduce power system mass by eliminating a conventional power-processing unit. The Environmental Effects Group has configured two large vacuum chambers to test different high-voltage array concepts in a plasma environment. Three types of solar arrays have so far been tested, an International Space Station (ISS) planar array, a Tecstar planar array, and a Tecstar solar concentrator array. The plasma environment was generated using a hollow cathode plasma source, which yielded densities between $10(\text{exp } 6)$ - $10(\text{exp } 7)$ per cubic centimeter and electron temperatures of 0.5-1 eV. Each array was positioned in this plasma and biased in the -500 to + 500 volt range. The current collection was monitored continuously. In addition, the characteristics of arcing, snap over, and other features, were recorded. Analysis of the array performance indicates a time dependence associated with the current collection as well as a tendency for 'conditioning' over a large number of runs. Mitigation strategies, to reduce parasitic current collection, as well as arcing, include changing cover-glass geometry and layout as well as shielding the solar cell edges. High voltage performance data for each of the solar array types tested will be presented. In addition, data will be provided to indicate the effectiveness of the mitigation techniques.

Author

Plasma Interactions; Solar Arrays; High Voltages; Hall Effect; Environment Effects

20030066501 NASA Marshall Space Flight Center, Huntsville, AL, USA

Calculation of Turbine Axial Thrust by Coupled CFD Simulations of the Main Flow Path and Secondary Cavity Flow in an SLI LOX Turbine

Dorney, D. J.; Marci, Bogdan; Tran, Ken; Sargent, Scott; [2003]; 15 pp.; In English; 39th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, 20-23 Jul. 2003, Huntsville, AL, USA; Original contains black and white illustrations Report No.(s): AIAA Paper 2003-4919; Copyright; Avail: CASI; A03, Hardcopy

Each single reusable Space Launch Initiative (SLI) booster rocket is an engine operating at a record vacuum thrust level of over 730,000 lbf using LOX and LH2. This thrust is more than 10% greater than that of the Delta IV rocket, resulting in relatively large LOX and LH2 turbopumps. Since the SLI rocket employs a staged combustion cycle the level of pressure is

very high (thousands of psia). This high pressure creates many engineering challenges, including the balancing of axial-forces on the turbopumps. One of the main parameters in the calculation of the axial force is the cavity pressure upstream of the turbine disk. The flow in this cavity is very complex. The lack of understanding of this flow environment hinders the accurate prediction of axial thrust. In order to narrow down the uncertainty band around the actual turbine axial force, a coupled, unsteady computational methodology has been developed to simulate the interaction between the turbine main flow path and the cavity flow. The CORSAIR solver, an unsteady three-dimensional Navier-Stokes code for turbomachinery applications, was used to solve for both the main and the secondary flow fields. Turbine axial thrust values are presented in conjunction with the CFD simulation, together with several considerations regarding the turbine instrumentation for axial thrust estimations during test.

Author

High Pressure; Thrust; Turbine Pumps; Computational Fluid Dynamics; Cavity Flow; Secondary Flow; Turbomachinery; Flow Distribution

20030066517 NASA Marshall Space Flight Center, Huntsville, AL, USA

MC-1 Engine Valves, Lessons Learned

Laszar, John; May 2, 2003; 9 pp.; In English; 39th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 20-23 Jul. 2003, Huntsville, AL, USA; No Copyright; Avail: CASI; [A02](#), Hardcopy

Many lessons were learned during the development of the valves for the MC-1 engine. The purpose of this report is to focus on a variety of issues related to the engine valves and convey the lessons learned. This paper will not delve into detailed technical analysis of the components. None of the lessons learned are new or surprising, but simply reinforce the importance of addressing the details of the design early, at the component level. The Marshall Space Flight Center (MSFC), Huntsville, Alabama developed the MC-1 engine, a LOX / FW-1, 60,000 pound thrust engine. This engine was developed under the Low Cost Boost Technology office at MSFC and proved to be a very successful project for the MSFC Propulsion team and the various subcontractors working the development of the engine and its components.

Author

Liquid Oxygen; Propulsion; Valves

20030066527 NASA Marshall Space Flight Center, Huntsville, AL, USA

Cycle Trades for Nuclear Thermal Rocket Propulsion Systems

White, C.; Guidos, M.; Greene, W.; [2003]; 10 pp.; In English; 39th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, 20-23 Jul. 2003, Huntsville, AL, USA

Report No.(s): AIAA Paper 2003-5131; No Copyright; Avail: CASI; [A02](#), Hardcopy

Nuclear fission has been used as a reliable source for utility power in the USA for decades. Even in the 1940's, long before the USA had a viable space program, the theoretical benefits of nuclear power as applied to space travel were being explored. These benefits include long-life operation and high performance, particularly in the form of vehicle power density, enabling longer-lasting space missions. The configurations for nuclear rocket systems and chemical rocket systems are similar except that a nuclear rocket utilizes a fission reactor as its heat source. This thermal energy can be utilized directly to heat propellants that are then accelerated through a nozzle to generate thrust or it can be used as part of an electricity generation system. The former approach is Nuclear Thermal Propulsion (NTP) and the latter is Nuclear Electric Propulsion (NEP), which is then used to power thruster technologies such as ion thrusters. This paper will explore a number of indirect-NTP engine cycle configurations using assumed performance constraints and requirements, discuss the advantages and disadvantages of each cycle configuration, and present preliminary performance and size results. This paper is intended to lay the groundwork for future efforts in the development of a practical NTP system or a combined NTP/NEP hybrid system.

Author

Nuclear Fission; Thermal Energy; Rocket Engines; Nuclear Electric Propulsion; Heat Sources

20030066932 NASA Marshall Space Flight Center, Huntsville, AL, USA

Analysis of Parallel Burn, No-Crossfeed TSTO RLV Architectures and Comparison to Parallel Burn with Crossfeed and Series Burn Architectures

Smith, Garrett; Philips, Alan; [2003]; 10 pp.; In English; 39th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 20-23 Jul. 2003, Huntsville, AL, USA

Report No.(s): AIAA Paper 2003-5244; Copyright; Avail: CASI; [A02](#), Hardcopy

Three dominant Two Stage To Orbit (TSTO) class architectures were studied: Series Burn (SB), Parallel Burn with

crossfeed (PBw/cf), and Parallel Burn, no-crossfeed (PBncf). The study goal was to determine what factors uniquely affect PBncf architectures, how each of these factors interact, and to determine from a performance perspective whether a PBncf vehicle could be competitive with a PBw/cf or a SB vehicle using equivalent technology and assumptions. In all cases, performance was evaluated on a relative basis for a fixed payload and mission by comparing gross and dry vehicle masses of a closed vehicle. Propellant combinations studied were LOX: LH2 propelled booster and orbiter (HH) and LOX: Kerosene booster with LOX: LH2 orbiter (KH). The study observations were: 1) A PBncf orbiter should be throttled as deeply as possible after launch until the staging point. 2) A PBncf TSTO architecture is feasible for systems that stage at mach 7. 2a) HH architectures can achieve a mass growth relative to PBw/cf of <20%. 2b) KH architectures can achieve a mass growth relative to Series Burn of <20%. 3) Center of gravity (CG) control will be a major issue for a PBncf vehicle, due to the low orbiter specific thrust to weight ratio and to the position of the orbiter required to align the nozzle heights at liftoff. 4) Thrust to weight ratios of 1.3 at liftoff and between 1.0 and 0.9 when staging at mach 7 appear to be close to ideal for PBncf vehicles. 5) Performance for HH vehicles was better when staged at mach 7 instead of mach 5. The study suggests possible methods to maximize performance of PBncf vehicle architectures in order to meet mission design requirements.

Author

Liquid Hydrogen; Low Thrust; Propellants

20030066989 NASA Marshall Space Flight Center, Huntsville, AL, USA

Plasma Sheath Behavior of the ProSEDS Delta II

Wright, K. H.; Stone, N. H.; Gilchrist, B. E.; Vaughn, J.; Garbe, G.; [2003]; 1 pp.; In English; 39th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, 20-23 Jul. 2003, Huntsville, AL, USA; Copyright; Avail: Other Sources; Abstract Only

The Propulsive Small Expendable Deployer System (ProSEDS) mission is a demonstration of the orbit lowering capabilities of an electrodynamic tether. The system is sequenced through various electrical modes, involving both open circuit and closed circuit configurations, so that the performance capabilities of the system can be studied. Ionospheric electrons are collected on the upper end of the bare tether, conducted through the tether, and returned to the ionosphere at the lower end (Delta II 2nd stage) via the operation of a Hollow Cathode Plasma Contactor (HCPC). The working gas of the HCPC is xenon. Environmental plasma measurements and sheath potential are obtained from the Differential Ion Flux Probe w/Mass Analysis (DIFPM) and Langmuir Probe and Spacecraft Potential (LPSP) instruments. Each instrument has three sensors symmetrically placed about the strut section of the Delta 2nd stage. A magnetometer is also included in the ProSEDS instrumentation suite. An initial analysis of the rocket stage sheath behavior as a function of ProSEDS configuration (open or closed circuit), ambient ionospheric density, orientation to velocity vector (ram-wake influence), and magnetic field orientation is presented. An initial assessment on how well the plasma contactor grounded the rocket stage is also presented.

Author

Tethering; Plasma Sheaths; Electrostatic Probes; Plasma Propulsion

20030067279 Hercules Aerospace Co., Magna, UT

Solar-Powered Rocket Engine Optimized for High Specific Impulse

Pande, J. B.; Jan. 1994; 7 pp.; In English

Report No.(s): AD-A413742; No Copyright; Avail: CASI; A02, Hardcopy

Hercules Aerospace is currently developing a solar-powered rocket engine (SPRE) design optimized for high specific impulse (Isp). The SPRE features low loss geometry in its light-gathering cavity, which includes an integral secondary concentrator. The simple one-piece heat exchanger is made from refractory metal and/or ceramic open-celled foam. The foam's high surface-area-to-volume ratio will efficiently transfer thermal energy to the hydrogen propellant. The single-pass flow of propellant through the heat exchanger further boosts thermal efficiency by regeneratively cooling surfaces near the entrance of the optical cavity. These surfaces would otherwise reradiate a significant portion of the captured solar energy back out the cavity entrance. Such design elements promote a high overall thermal efficiency and hence a high operating Isp.

DTIC

Solar Propulsion; Rocket Engines

20030067378 NASA Marshall Space Flight Center, Huntsville, AL, USA

Fundamentals of Plasma Sails Propulsion Concept

Khazanov, G. V.; Kabin, K.; Delamere, P. A.; [2002]; 1 pp.; In English; 39th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 20-23 Jul. 2003, Huntsville, AL, USA; No Copyright; Avail: Other Sources; Abstract Only

The Mini-Magnetospheric Plasma Propulsion (M2P2), originally proposed by Winglee et al. [2000], is based on the

two-fluid plasma model and requires a 15-km frontal standoff distance (or 20-km cross-sectional diameter) in order for the magnetic bubble to absorb sufficient momentum from the SW to accelerate a spacecraft to the unprecedented speeds of 50-80 km/s after an acceleration period of about three months. Winglee et al. [2000] derived the above size requirement based on an extrapolation of their simulated results in which a system much smaller than a M2P2 was used (p. 21,074 of their study). We submit, however, that a fluid model has no validity for such a small scale size-even in the region near the plasma source! It is assumed in the MHD fluid model, normally applied to the magnetosphere, that the characteristic scale-size is much greater than the Larmor radius and ion skin depth of the SW. In the case of the M2P2, however, the size of the magnetic bubble is actually less than or, at best, comparable to, the scale of these characteristic parameters and, therefore, a kinetic approach, which addresses the smallscale physical mechanisms involved, must be used. A fully three-dimensional version of the hybrid code is used in our M2P2 (Plasma Sails) studies was originally developed by Delamere et al. [1999]. The M2P2 plasma sail is an excellent application for this hybrid code. The primary advantage of this code is the seamless interface between fluid and kinetic descriptions of the ion populations. A kinetic description is not necessary for the dense inner regions of the magnetic bubble and tremendous computational savings can be realized by treating this dense, magnetized ion population with the fluid description. It is essential, however, that the outer bubble regions be treated kinetically as well as the SW protons. Comparison of full size M2P2 simulation based on 3D MHD and kinetic models show that kinetic treatment introduces much more asymmetry to the considering problem and the possibility of kinetic instabilities development.

Author

Plasma Propulsion; Magnetospheres; Fluid Flow; Mathematical Models; Two Fluid Models

20030067417 NASA Marshall Space Flight Center, Huntsville, AL, USA

High-Energy Two-Stage Pulsed Plasma Thruster

Markusic, Tom; [2003]; 1 pp.; In English; 39th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, 20-23 Jul. 2003, Huntsville, AL, USA; No Copyright; Avail: Other Sources; Abstract Only

A high-energy (28 kJ per pulse) two-stage pulsed plasma thruster (MSFC PPT-1) has been constructed and tested. The motivation of this project is to develop a high power (approximately 500 kW), high specific impulse (approximately 10000 s), highly efficient (greater than 50%) thruster for use as primary propulsion in a high power nuclear electric propulsion system. PPT-1 was designed to overcome four negative characteristics which have detracted from the utility of pulsed plasma thrusters: poor electrical efficiency, poor propellant utilization efficiency, electrode erosion, and reliability issues associated with the use of high speed gas valves and high current switches. Traditional PPTs have been plagued with poor efficiency because they have not been operated in a plasma regime that fully exploits the potential benefits of pulsed plasma acceleration by electromagnetic forces. PPTs have generally been used to accelerate low-density plasmas with long current pulses. Operation of thrusters in this plasma regime allows for the development of certain undesirable particle-kinetic effects, such as Hall effect-induced current sheet canting. PPT-1 was designed to propel a highly collisional, dense plasma that has more fluid-like properties and, hence, is more effectively pushed by a magnetic field. The high-density plasma loading into the second stage of the accelerator is achieved through the use of a dense plasma injector (first stage). The injector produces a thermal plasma, derived from a molten lithium propellant feed system, which is subsequently accelerated by the second stage using mega-amp level currents, which eject the plasma at a speed on the order of 100 kilometers per second. Traditional PPTs also suffer from dynamic efficiency losses associated with snowplow loading of distributed neutral propellant. The twostage scheme used in PPT-I allows the propellant to be loaded in a manner which more closely approximates the optimal slug loading. Lithium propellant was chosen to test whether or not the reduced electrode erosion found in the Lithium Lorentz Force Accelerator (LiLFA) could also be realized in a pulsed plasma thruster. The use of the molten lithium dense plasma injector also eliminates the need for a gas valve and electrical switch; the injector design fulfills both roles, and uses no moving parts to provide, in principle, a highly reliable propellant feed and electrical switching system. Experimental results reported in this paper include: second-stage current traces, high-speed photographic and holographic imaging of the thruster exit plume, and internal mapping of the discharge chamber magnetic field from B-dot probe data. The magnetic field data is used to create a two-dimensional description of the evolution of the current sheet inside the thruster.

Author

High Speed; Magnetic Fields; Plasma Acceleration; Plasmas (Physics); Pulsed Plasma Thrusters; Nuclear Electric Propulsion

20030067419 NASA Marshall Space Flight Center, Huntsville, AL, USA

Quasi-One-Dimensional Modeling of Pulse Detonation Rocket Engines

Morris, Christopher I.; [2003]; 15 pp.; In English; 39th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 20-23 Jul. 2003, Huntsville, AL, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy

This viewgraph presentation provides information on the engine cycle of a pulse detonation rocket engine (PDRE), models for optimizing the performance of a PDRE, and the performance of PDREs in comparison to Solid State Rocket Engines (SSREs).

CASI

Pulse Detonation Engines; Mathematical Models; Numerical Analysis; Optimization; Propulsion System Performance

20030067466

The Potential for Ozone Depletion in Solid Rocket Motor Plumes by Heterogeneous Chemistry

Hanning-Lee, M. S.; Felker, P. M.; Syage, J. A.; Lamb, John J.; Aug. 1996; 22 pp.; In English

Report No.(s): AD-A414279; No Copyright; Avail: CASI; [A03](#), Hardcopy

Rates of ozone decomposition on aluminum oxide (alumina) particles were measured in a flow tube reactor equipped with molecular beam sampling mass spectrometry and ultraviolet absorption spectroscopy, and in a static reaction cell equipped with ultraviolet absorption spectroscopy. Reaction probabilities η are reported for ozone on alpha-alumina, gamma-alumina, and chromatographic alumina (hydroxylated alumina), respectively, over the temperature range -60 to 200 degrees C. This work addresses the potential for stratospheric ozone depletion by launch vehicle solid rocket motor exhaust. Considering best estimates of plume particle size distributions and dispersion rates, we calculate ozone depletion profiles, for direct decomposition on alumina only. The calculated ozone holes are rather narrow. In the worst case, ozone levels are within 5×10^{-5} of ambient in the center of the plume. A simple analysis of the global impact of alumina particles on 9 ozone decomposition indicates a potential steady-state daytime depletion of $< 3 \times 10^{-9}$ at present launch rates. The laboratory measurements presented here support atmospheric modeling efforts to understand rocket plume I stratosphere interactions. The laboratory and modeling work in turn is used to define design parameters for the High Resolution Ozone Imaging (HIROIG) spectrometer to be used to monitor ozone and chemical composition of solid rocket motor plumes.

DTIC

Solid Propellant Rocket Engines; Rocket Exhaust; Ozone Depletion

23

CHEMISTRY AND MATERIALS (GENERAL)

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see *categories 25 through 29*. For astrochemistry see category *90 Astrophysics*.

20030066365 NASA Marshall Space Flight Center, Huntsville, AL, USA

Proof Test Diagrams for a Lithia-Alumina-Silica Glass-Ceramic

Tucker, Dennis S.; [2003]; 5 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The glass-ceramic (Zerodur, Schott Glaswerke, Mainz, Germany) contains 70% to 78% by weight crystalline phase of high-quartz structure with a mean crystal size of 50-55 nm. The vitreous phase has a positive thermal expansion coefficient which is practically balanced by the negative coefficient of the crystalline phase. This results in a material which can maintain longitudinal stability during thermal cycling. This was one of the reasons for its choice as the material for the grazing incidence mirrors for the Chandra X-Ray Facility. Brittle materials such as glass and glass-ceramics which exhibit slow crack growth and subsequent fast fracture to failure exhibit a time dependence in strength. The decrease in strength for a constant applied load is known as static fatigue. In many cases, environment plays a major role in the material lifetime. It has been shown for silicate glasses that crack velocity will increase as the amount of water vapor in the environment surface finish and rate of loading. A rough surface finish leads to a lower tensile strength than for an optically polished surface. The strength of glass is observed in general to increase with increasing load rate. This phenomena is known as dynamic fatigue. This was observed for Zerodur by Tucker and Gent and Tucker in previous dynamic fatigue studies, in which lifetimes were obtained. All of the above named factors need to be considered when glass is to be used in load bearing applications.

Author

Ceramics; Silica Glass; Aluminum Oxides; Brittle Materials; Thermal Cycling Tests; Tensile Strength; Crack Propagation; Crystallinity

20030066930 North Carolina Univ., Chapel Hill, NC, USA

Chemical Modification of Nanotubes for Composites

Samulski, Edward T.; [2003]; 4 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAG1-2301; No Copyright; Avail: CASI; [A01](#), Hardcopy

In the production of mesoscopically-engineered materials based on single-walled carbon nanotubes (SWNTs), monitoring the stages of chemical modification will be an important step in the fabrication of usable composite materials. In our research program we developed tools for studying high-temperature composites with a long-term goal of having such instrumentation available for SWNT composite analyses.

Author

Carbon Nanotubes; Fabrication; Composite Materials

20030067190 Northwestern Univ., Evanston, IL

Chemistry of Oligonucleotide-Gold Nanoparticle Conjugates

Letsinger, Robert L.; Mirkin, Chad A.; Elghanian, Robert; Mucic, Robert C.; Storhoff, James I.; Mar. 15, 2003; 5 pp.; In English

Contract(s)/Grant(s): DAAG55-97-1-0133; GM058356

Report No.(s): AD-A413421; ARO-37257.26-MUR; No Copyright; Avail: CASI; [A01](#), Hardcopy

Conjugates prepared by immobilizing thiol-terminated oligonucleotides onto gold nanoparticles from stable colloidal solutions in aqueous media. The oligonucleotides can serve as linkers to organize the gold particles reversibly into three dimensional arrays and the gold particles can function as colorimetric reporters for hybridization of the bound oligomers with target oligonucleotides in solution.

DTIC

Radioactive Materials; Gold; Oligomers; Thiols

20030067201 Drexel Univ., Philadelphia, PA

The Chemistry Controlling Ignition of Hydrocarbons and Their Mixtures at High Pressure

Cernansky, N. P.; Miller, D. L.; Jun. 30, 2002; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAG55-98-1-0286

Report No.(s): AD-A413495; No Copyright; Avail: CASI; [A03](#), Hardcopy

A research program to study the oxidation and ignition chemistry of single and multiple component hydrocarbon fuels at high pressures has been conducted at Drexel University. The current program was initiated in May 1998 through a grant from the Army Research Office (Grant No. DAAG55-98-1-0286, Project No. 37699-EG) and was completed in April 2002. The program was augmented by efforts under an associated AASERT award (Grant No. DAAG55-97-1-0196; Project No. 36910-EG-AAS). The purpose of this project was to investigate the complex interactions between individual components of 2, 3, and 4 component mixtures and full boiling range fuels by developing kinetic and mechanistic information in the low and intermediate temperature ranges (600-1000 K) and at elevated pressures (up to 20 atm). In addition, simplified blends were developed to mimic the behavior of gasoline and JP-8 distillate fuels in the low and intermediate temperature regime.

DTIC

High Pressure; Hydrocarbon Fuels; Ignition; Mixtures; Oxidation; Chemical Reactions

20030067310 Virginia Univ., Charlottesville, VA, USA

DNA Low-Frequency Internal Vibrations

Bykhovskaia, M.; Feb. 20, 2002; 14 pp.; In English

Contract(s)/Grant(s): DAAD19-00-1-04-02

Report No.(s): AD-A414567; No Copyright; Avail: CASI; [A03](#), Hardcopy

We performed a series of FTIR measurements of DNA absorption spectra in THz range and confirmed that these spectra of nucleic acids can serve as a signature of their structure. We also have suggested a method for the prediction of far infrared absorption spectra in THz region for biomolecules. This theoretical method includes 1) energy minimization, 2) calculation of normal modes, 3) calculation of dipole oscillations, 4) calculations of IR absorption. We have calculated normal modes and their oscillator strengths for a number of synthetic DNA and RNA molecules with known base pair sequence. The calculated positions of the resonance peaks in absorption spectra were found to be in a good agreement with those obtained experimentally, which validates both the predictive power of our theoretical methods and accuracy of experimental measurements.

DTIC

Vibration; Dipoles; Molecular Structure; Absorption Spectra

COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

20030067142 Air Force Research Lab., Edwards AFB, CA, USA

Investigating the Constraint Effect in a Particulate Composite Material

Liu, C. T.; Feb. 25, 2002; 12 pp.; In English

Contract(s)/Grant(s): Proj-2302

Report No.(s): AD-A410745; AFRL-PR-ED-TP-2002-039; No Copyright; Avail: CASI; [A03](#), Hardcopy

In this study, the effect of constraint on the critical Mode I stress intensity factor for the onset of crack growth was investigated in a particulate composite material, containing hard particles in a rubbery matrix. Uniaxial specimens with different specimen thicknesses and initial crack lengths were tested under a constant grain rate of 8 cm/cm/min at room temperature. The tested data was analyzed and the results are discussed.

DTIC

Composite Materials; Critical Loading; Particulates

20030067294 Nevada Univ., Reno, NV

High Performance Woven Mesh Heat Exchange

Wirtz, R. A.; Apr. 2003; 55 pp.; In English

Contract(s)/Grant(s): F49620-99-1-0286

Report No.(s): AD-A414464; 1330-117-30AG; No Copyright; Avail: CASI; [A04](#), Hardcopy

Woven mesh structures, consisting of bonded laminates of plain-weave conductive screens or three-dimensional orthogonal weaves are described. A mathematical model of the thermal performance of such a mesh, deployed as a heat exchange surface shows that the effective conductance of a thin, porous heat exchange matrix is proportional to the square root of the product of the specific surface area, effective thermal conductivity and mesh heat transfer coefficient. Geometric equations show that these porous matrices can be fabricated to have a wide range of porosity and specific surface area. Furthermore, a highly anisotropic thermal conductivity vector can be achieved, with the in-plane effective thermal conductivity ranging to 78.5% of the filament material values. Measurements of pressure drop and overall heat transfer rate are reported and used to develop correlation equations of mesh friction factor and Colburn j-factor as a function of coolant properties, mesh characteristics and flow rate through the mesh. Experiments with air and water show that mesh heat transfer coefficients and friction factors are comparable to those achieved with other expanded materials. However, high specific surface area coupled with high effective thermal conductivity result in exchange matrices that out-perform other exchange matrix configurations.

DTIC

Heat Transfer Coefficients; Heat Exchangers

20030067351 Technische Univ., Delft

Sandwich Element of the Second Kind into B2000

Smits, B. L.; May 1999; 114 pp.; In English

Report No.(s): PB2003-104786; M-874; Copyright; Avail: National Technical Information Service (NTIS)

Because of their lightweight, high stiffness, high structural efficiency, and durability, sandwich panels and shells are candidates for use in future high-speed aircraft, hypersonic aerospacecraft, and spacecraft with stringent precision requirements. In the past years, analysis of sandwich structures with traditional cores has been investigated using a classical approach based on a single layer model. However, due to their very low rigidity, they are also transversely flexible. Therefore, a new approach that compasses 'transversely' flexible cores is derived. This new approach for sandwich structures is utilized using a three-layer sandwich modeling. Consider two faces to be shells (with bending as well as the usual membrane stiffness) that are held apart by a lightweight core, which can have three dimensional elastic properties. This type of model is called a sandwich of the second kind. The model described is suitable for sandwich structures with a thick 'transversely' soft core. By defining more layers to be shells and holding them all apart by the lightweight cores even laminates can be defined.

NTIS

Sandwich Structures; Aerospace Planes; Hypersonic Vehicles

20030067389 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA

Advanced Composite Performance: Material Behavior and Life Cycle Prediction for Rotating Machines

Case, Scott W.; Reifsnider, Kenneth L.; Mar. 26, 2003; 60 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-01-1-0694

Report No.(s): AD-A414609; ARO-42451-EG.1; No Copyright; Avail: CASI; [A04](#), Hardcopy

The Virginia Tech life prediction methodology is applied to composite materials to determine a fundamental understanding of material behavior and life cycle issues (e.g. fatigue damage, creep, creep rupture). Specific areas addressed in this activity include: (1) establishing the likely damage and failure modes for rotating machines; (2) constructing micromechanical models of the material failure modes; (3) constructing a methodology for the life analysis of composite rotors operating under high temperature and loading.

DTIC

Composite Materials; Prediction Analysis Techniques; Fatigue (Materials); Creep Properties

20030067432 Air Force Research Lab. Kirtland AFB NM Directed Energy Directorate, Kirtland AFB, NM, USA

Mechanics of a Near Net-Shape Stress-Coated Membrane. Volume I of II: theory Development Using the Method of Asymptotic Expansions

Wilkes, James M.; Dec. 2002; 66 pp.; In English

Contract(s)/Grant(s): Proj-2302

Report No.(s): AD-A414465; AFRL-DE-TR-2002-1063-VOL-1; No Copyright; Avail: CASI; [A04](#), Hardcopy

The method of asymptotic expansions was applied to the geometrically nonlinear, three-dimensional equations of a coated membrane laminate, each material component of which was assumed to be a linear, uniform, homogeneous, and isotropic elastic material in which there exist residual stresses. Our goal was to systematically derive by a single method the generalizations of four well-known theories of a single material to a coated membrane laminate. Two of the theories, one geometrically linear, the other geometrically nonlinear, describe a true membrane laminate offering no resistance to bending. These are applicable to membrane laminate vibration analysis, and pressurized stress-coated membranes undergoing large deflections, respectively. The other two describe stress-coated membrane shells having small but non-zero bending stiffness; these theories are to be used to determine a coating stress prescription that will maintain the shape of an initially parabolic stress-coated membrane laminate. Solutions of associated boundary value problems are given in Volume II of the report.

DTIC

Laminates; Asymptotic Series; Coating; Membrane Structures; Dynamic Structural Analysis

20030067518

Estimating the Initial Crack Size in a Particulate Composite Material: An Analytical and Experimental Approach

Liu, C. T.; May 23, 2001; 8 pp.; In English

Contract(s)/Grant(s): Proj-2302

Report No.(s): AD-A413004; AFRL-PR-ED-TP-2001-121; No Copyright; Avail: CASI; [A02](#), Hardcopy

In this study, a technique to predict the equivalent initial crack size (EICS) in a particulate composite material, containing hard particles embedded in a rubber matrix, was developed using constant strain rate crack propagation test data. The accuracy of the developed technique was determined. In addition, the statistical distribution of the equivalent initial crack size follows the second asymptotic distribution of maximum value.

DTIC

Composite Materials; Crack Propagation; Numerical Analysis

20030067519

Multi-Scale Strain Measurements of a Particulate Composite Material

Liu, C. T.; Smith, C. W.; Ravichandran, G.; Nov. 2002; 14 pp.; In English

Contract(s)/Grant(s): Proj-2302

Report No.(s): AD-A413005; AFRL-PR-ED-VG-2002-258; No Copyright; Avail: CASI; [A03](#), Hardcopy

The objectives in this report are as follows: (1) Investigate the effect of microstructure on the strain distributions near a crack tip. (2) Conduct numerical modeling analysis to determine the displacement and strain fields.

DTIC

Composite Materials; Mathematical Models; Particulates; Strain Measurement

20030067523

Hybrid Experimental-Numerical J-Integral Analysis and Crack Growth Resistance of a Particulate Composite Material

Liu, C. T.; Gonzalez, Javier; Jul. 24, 2001; 15 pp.; In English

Contract(s)/Grant(s): Proj-2802

Report No.(s): AD-A413003; AFRL-PR-ED-VG-2001-168; No Copyright; Avail: CASI; [A03](#), Hardcopy

The objectives of this study were as follows: 1) Investigate the inhomogeneous nature of the Microstructure. 2) Determine J-Integral using a hybrid experimental-numerical technique. 3) Investigate crack growth behavior.

DTIC

Composite Materials; Crack Propagation; J Integral; Numerical Analysis; Particulates; Structural Reliability

20030067586 NASA Marshall Space Flight Center, Huntsville, AL, USA

X-33 LH2 Tank Failure Investigation Findings

Niedermeyer, Melinda; [2003]; 29 pp.; In English; International Conference on Composites Engineering, 20-25 Jul. 2003, New Orleans, LA, USA; No Copyright; Avail: CASI; [A03](#), Hardcopy

This viewgraph presentation provides information on the composite sandwich-honeycomb structure of the liquid hydrogen tank of the X-33 reusable launch vehicle, and describes why the the first pressure test to determine the tank's structural integrity failed. The presentation includes images of the tank before and after the failed test, including photomicrographs. It then reaches conclusions on the nature of the microcracks which caused the liquid hydrogen leakage. CASI

X-33 Reusable Launch Vehicle; Structural Failure; Liquid Hydrogen; Microcracks; Leakage

20030067645

Multi-Scale Strain Measurements of a Polymeric Material

Liu, C. T.; Chiang, Fu-Pen; May 2003; 18 pp.; In English

Contract(s)/Grant(s): Proj-2302

Report No.(s): AD-A414832; AFRL-PR-ED-VG-2003-117; No Copyright; Avail: CASI; [A03](#), Hardcopy

The objectives are to determine the Displacement and Strain Fields in a Polymeric Material and to investigate the Local Damage Mechanisms and Failure Behavior near the Crack Tip.

DTIC

Composite Materials; Strain Measurement; Strain Distribution

25

INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

Includes the analysis, synthesis, and use of inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see category *34 Fluid Dynamics and Thermodynamics*. For astrochemistry see category *90 Astrophysics*.

20030066254

Derivation of Exposure Duration-Specific Occupational Exposure Limits (OELS) for 4, 6-Dimethyl-2-Heptanone (CAS# 19549-80-5)

Arfsten, Darryl P.; Kane, Linda V.; Still, Kenneth R.; Jul. 2002; 7 pp.; In English

Report No.(s): AD-A414142; No Copyright; Avail: CASI; [A02](#), Hardcopy

Occupational Exposure Limits (OELs) were calculated for 4,6-dimethyl-2-heptanone (CAS# 19549-80-5) using procedures established by the National Research Council (2001) for calculating Acute Exposure Guideline Levels. There were no appropriate toxicity data available for 4, 6-dimethyl-2-heptanone to use in calculating OELs. 4, 6-Dimethyl-2-heptanone is similar in chemical structure to 2-6-dimethyl-4-heptanone. The NOEL for 2-6-dimethyl-4-heptanone toxicity in rats of 125 ppm was used as a point of departure for estimating OELs for 4, 6-dimethyl-2-heptanone. An total uncertainty factor of 300 was applied to the estimated NOEL to account for lack of toxicity information for 4,6-dimethyl-2-heptanone (UF1 = 10), uncertainty associated with extrapolating to humans from animal study data (UF2 = 10), and uncertainty of the existence of individuals within the population that may be very reactive to 4,6-dimethyl-2-heptanone exposure (UF3 = 3). The calculated

OELs for 4,6-dimethyl-2-heptanone ranged from 1.8 ppm for a 5-minute exposure to 0.36 ppm for a 480-minute exposure.
DTIC

Toxicity; Chemical Composition; Reactivity

20030066258

Identification and Elimination of Defects and Impurities in GaN

Look, David C.; Sep. 15, 2001; 22 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0347; AF Proj. 2305

Report No.(s): AD-A414168; AFRL-SR-AR-TR-03-0171; No Copyright; Avail: CASI; [A03](#), Hardcopy

The Wood-Witt Program is a shorthand title given to a group of coordinated efforts designed to identify and eliminate undesirable defects and impurities in GaN. It was begun by Cohn Wood (ONR) and Jerry Witt (AFOSR) in October of 1999. A few groups were directly funded to work on this task but many others also choose to participate because of the chance to compare results on well characterized samples. Presently, in September of 2002, some 37 people, from 7 different countries, have either supplied material or made measurements, and the total number of participants is at least 79.

DTIC

Impurities; Elimination; Gallium Nitrides; Defects

20030066554 Michigan Univ., Ann Arbor, MI, USA

Chemistry Related to Possible Outgassing Sources on Mars

Wong, A. S.; Atreya, S. K.; Renno, N. O.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

An earlier paper, Chemical markers of possible hot spots on Mars by A. S. Wong, S. K. Atreya and Th. Encrenaz, explored the modification of the atmosphere of Mars following an influx of methane, sulfur dioxide and hydrogen sulfide (CH₄, SO₂, H₂S) from any outgassing sources which are referred to as hot spots. The feasibility of detection of the new species by Planetary Fourier Spectrometer on Mars Express is reported in a subsequent paper, Atmospheric photochemistry above possible martian hot spots by A. S. Wong, S. K. Atreya, V. Formisano, Th. Encrenaz and N. Ignatiev. This abstract is a follow-up on the previous two papers. Here we treat the effect of any outgassed halogens rigorously. We also make estimates of dilution factors relative to the source location following convection and meridional transport.

Derived from text

Atmospheric Chemistry; Mars (Planet); Outgassing; Photochemical Reactions; Mars Atmosphere; Halogens

20030066872 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA

Self-Ignition and Combustion of Gases

Sokolik, A. S.; Progress of Physical Science; August 1942; Volume 23, No. 3, pp. 209-250; In English

Report No.(s): NACA-TM-1025; No Copyright; Avail: CASI; [A04](#), Hardcopy

This paper attempts to state laws for the self-ignition and combustion of gases in a comprehensive manner.

CASI

Combustion Physics; Spontaneous Combustion; Flammable Gases

20030066926

Laser Applications to Chemical and Environmental Analysis

Feb. 28, 2003; 233 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0065

Report No.(s): AD-A413905; No Copyright; Avail: CASI; [A11](#), Hardcopy

The OSA topical meetings that received support under this grant provided a forum for researchers in various specialty areas to meet and share ideas and technology in their fields. Following are the meetings that were supported by this grant: 1. Advanced Solid State Lasers - This meeting provided a forum for leading edge results in the fields of solid state lasers, laser materials, nonlinear optical materials and high power diode lasers. 2. Laser Applications to Chemical and Environmental Analysis - This meeting presented and discussed advances in the use of lasers for chemical analysis and environmental monitoring. 3. Biomedical Optics - This meeting was composed of three meetings that offered a unique venue to present and discuss recent research activities and developments in the field of lasers and optics in biomedicine. 4. Ultrafast Phenomena This meeting brought together a multidisciplinary group sharing a common interest in the generation of ultrashort pulses in

the picosecond, femtosecond, and attosecond regimes and their application to studies of ultrafast phenomena in physics, chemistry, biology, material sciences and electronics. 6. Nonlinear Optics - This meeting provided an international forum for discussion of all aspects of nonlinear optics, including new phenomena, novel devices, advanced materials and applications. 7. Nonlinear Guided Waves and their Applications - This meeting emphasized development of new ideas and novel techniques in the areas of materials, fabrication, devices, applications and nonlinear theory. 8. Laser Induced Plasma Spectroscopy and Applications - This meeting focused on major advances in LIBS fundamentals, instrumentation and applications and featured new commercial laboratory LIBS systems and advanced components, as well as field portable systems.

DTIC

Laser Applications; Chemical Analysis; Environmental Monitoring; Laser-Induced Breakdown Spectroscopy; Solid State Lasers

20030067216 CH2M HILL Hanford Group, Inc., Richland, WA, USA

Double-Shell Tanks Chemistry Control Data Quality Objectives

Banning, D. L.; Oct. 08, 2001; 28 pp.; In English

Report No.(s): DE2003-807477; RPP-8532-REV-3; No Copyright; Avail: Department of Energy Information Bridge

One of the main functions of the River Protection Project is to store the Hanford Site tank waste until the Waste Treatment Plant (WTP) is ready to receive and process the waste. Waste from the older single-shell tanks is being transferred to the newer double-shell tanks (DSTs). Therefore, the integrity of the DSTs must be maintained until the waste from all tanks has been retrieved and transferred to the WTP. To help maintain the integrity of the DSTs over the life of the project, specific chemistry limits have been established to control corrosion of the DSTs. These waste chemistry limits are presented in the Technical Safety Requirements (TSR) document HNF-SD-WM-TSR-006, Sec. 5. IS, Rev 2B (CHG 2001). In order to control the chemistry in the DSTs, the Chemistry Control Program will require analyses of the tank waste.

NTIS

Waste Treatment; Chemical Analysis; Industrial Plants; Tanks (Containers)

20030067244 Nebraska Univ., Lincoln, NE

Studies on the Microwave Optics of Ionic Molecular Solids

Hardy, John R.; Mar. 15, 2002; 19 pp.; In English

Contract(s)/Grant(s): DAAG55-97-1-0106

Report No.(s): AD-A413643; ARO-35869.15-PH; No Copyright; Avail: CASI; [A03](#), Hardcopy

Work carried out under this grant is summarized. In particular, the prediction of a novel ferroelectric material NaCaF₃ is described and its predicted properties summarized. First principles calculations on a wide range of ionic molecular solids are summarized. These range from studies on halide perovskites to work on alkaline earth silicates. In most cases very reasonable accord with experiment is achieved. One notable exception is the class of alkali cyanides which clearly require more sophisticated treatment. The basic theoretical approach is a combination of a Gordon-Kim modified electron gas theory with the quantum chemistry GAUSSIAN code to handle covalently bonded molecular ions. As indicated, this parameter free treatment reproduces experimental phase diagrams with good accuracy.

DTIC

Ferroelectric Materials; Microwaves; Quantum Chemistry; Solids; Optics

20030067307 Rensselaer Polytechnic Inst., Troy, NY

Wide Temperature Range Kinetics of Elementary Combustion Reactions for Army Models

Fontijn, Arthur; Jul. 2002; 16 pp.; In English

Contract(s)/Grant(s): DAAD19-99-1-0209

Report No.(s): AD-A414563; ARO-38946.4-CH; No Copyright; Avail: CASI; [A03](#), Hardcopy

The goals of this program are to provide accurate kinetic data on isolated elementary reactions at temperatures relevant to Army combustion models, particularly for propellant combustion dark zones and also for development of halon replacements for fire retardation. Measurements have been made in high temperature photochemistry (HTP) reactors. Rate coefficient expressions over wide temperature ranges are reported for the reactions $O+N_2O \rightarrow O_2+N_2$, $N+N_2O \rightarrow N_2+NO$, $O+CHF_3 \rightarrow OH+CF_3$, $H+NO+Ar \rightarrow HNO+Ar$, $NH+CO_2 \rightarrow HNO+CO$. For the first of these reactions the relation to the alternate $2NO$ product channel is discussed. The potential impact of the results on the continuing development of Army models is considered. A statistical method has been developed for testing the exponentiality of noisy measurements in the time

domain, such as are sometimes obtained in HTP and many other types of experiments.

DTIC

Reaction Kinetics; Propellants; Combustion; Nitrates

20030067321 Air Force Research Lab., Edwards AFB, CA, USA

Detonations of Liquid Oxygen Sprays in Gaseous Hydrogen for Pulse Detonation Rockets

Coy, Edward; Watts, Jonathan; May 8, 2003; 2 pp.; In English

Contract(s)/Grant(s): Proj-2308

Report No.(s): AD-A414573; AFRL-PR-ED-AB-2003-128; No Copyright; Avail: CASI; [A01](#), Hardcopy

Detonations of flowing mixtures of cryogenic gaseous hydrogen and liquid oxygen at mixture densities of 3-6 Kg/cu m and varying liquid oxygen fractions have been studied. Wave speeds, pressures, and the time required to effect detonation-to-deflagration transition are reported. Data taken at cryogenic conditions are compared with data taken at equal initial densities and equivalence ratios, but at ambient temperature, as well as with equilibrium, Chapman-Jouget calculations. This work has been undertaken to support development of pulse detonation rocket engines. These results will be directly applicable to the development of the next generation of repetitively pulsed, multi-tube test articles and will also be used to qualify computational models under development for use in system application studies.

DTIC

Cryogenics; Liquid Oxygen; Deflagration; Detonation

20030067328 North Carolina Univ At Chapel Hill Dept. Of Mathematics, Chapel Hill, NC, USA

High Performance Macromolecular Material

Forest, M. G.; Nov. 2002; 11 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0008

Report No.(s): AD-A414177; AFRL-SR-AR-TR-03-0177; No Copyright; Avail: CASI; [A03](#), Hardcopy

Our early work centered upon microstructure coupling with strong flows, which include fiber spinning and general extensional flows. These remain the most successful flow-processing regimes for high-performance materials because hydrodynamics dominates the microscopic physics. In essence, most commercial high-performance polymers are processed through fiber spinning, following Nature and spider silk, which is still pound-for-pound the toughest liquid crystalline polymer. Our work has contributed toward the derivation of models, their analysis and computation, leading to quantitative models for steady, robust, and controllable microstructure alignment in extension-dominated liquid crystalline polymer flow processes 1, 2, 3, 4, 5, 6, 7, 10, 11, 12, 93. The current major efforts in materials design are toward fabricating 2 and 3 dimensional products, from thin films to solid structures. The highly successful fiber processes are not scalable: one has to weave volumes of fibers to make higher dimensional products, and then one only has homogenized averages of anisotropic fiber properties, where the averages must arise from mixing filaments. So one has to leave the 1 dimensional world of fibers and study either film flows or general mold-filling type flows. Such processes are dominated by shear components, which are weak flows marked by linear particle trajectories as opposed to exponential streamlines of extension-dominated flows.

DTIC

Macromolecules; Polymers; Mechanical Properties; Fluid Flow

20030067337 Army Research Lab., Adelphi, MD

Literature Review of Fuel Processing

Lee, Ivan C.; Chu, Deryn; Mar. 2003; 34 pp.; In English

Report No.(s): AD-A414453; ARL-TR-2946; No Copyright; Avail: CASI; [A03](#), Hardcopy

Technology is available for the development of hydrogen-fueled polymer electrolyte membrane (PEM) fuel cell systems of small and intermediate sizes. For the indirect use of organic fuels, such require the development of compact fuel processors to provide high purity hydrogen. Methanol fuel processors are under intensive research and development for that purpose. The associated technical challenges and approaches to their solutions are discussed. Integrated prototype systems of methanol processor and PEM fuel cell systems have been built for portable, mobile, and stationary applications. The additional technical barriers to be overcome for diesel or JP-8 reformers are much more formidable. Carbon and sulfur managements have to be addressed to develop a durable and high-performance logistic fuel reformer for Army applications. In addition, better carbon monoxide removal strategy is necessary, because logistic fuel reformers produce reformat gases containing high carbon

monoxide concentration. State-of-the-art logistic fuel reformers are reviewed.

DTIC

Fuels; Membranes; Electrolytic Cells; Methyl Alcohol; Fuel Cells; Polymers

20030067368 Defence Science and Technology Organisation, Salisbury, Australia

Composite Propellants with Bi-Plateau Burning Behaviour

Ide, Kym M.; Nov. 2002; 29 pp.; In English

Report No.(s): AD-A414445; DSTO-GD-0344; DODA-AR-012-509; No Copyright; Avail: CASI; [A03](#), Hardcopy

The literature describing the mechanism of combustion in composite rocket propellants exhibiting hi-plateau burning has been reviewed. A wide distribution of AP particle size in a definite coarse/fine ratio is required to ensure adequate interstitial spacing resulting in abnormally depressed burning due to interference of the fine AP fraction combustion by the binder melt layer. Titanium dioxide added to the formulation acts to increase the binder melt layer viscosity restoring normal burning at low and high pressures, leaving abnormal burning and a plateau or mesa effect at intermediate pressures. The use of dimeryl-diisocyanate curative produces a unique plateau at lower pressures due to increased binder liquefaction. Formulation variables can be adjusted to tailor the pressure levels and burn rates of the plateaus formed.

DTIC

Combustion; Composite Propellants; Burning Rate; Binders (Materials)

20030067374 Materials Research Society, Warrendale, PA

Symposium K: Silicon Carbide - Materials, Processing, and Devices

Sadow, Stephen E.; Saks, Nelson S.; Larkin, David J.; Schoener, Adolf; Dec. 2002; 23 pp.; In English

Contract(s)/Grant(s): N00014-03-1-0198

Report No.(s): AD-A414580; No Copyright; Avail: CASI; [A03](#), Hardcopy

Symposium K is the second in a series of SiC symposia at the MRS Fall Meeting. Since the last meeting in 2000, advances in SiC materials, processing, and device design have resulted in implementation of SiC-based electronic systems and offer great promise in high voltage, high temperature, high frequency applications. Presenters focused on new developments in the basic science of SiC materials as well as rapidly maturing device technologies. The challenges in this field include understanding and decreasing defect densities in bulk SiC crystals, controlling morphology and residual impurities in epilayers, optimization of implant activation and oxide-SiC interfaces, and developing novel device structures. Topics of particular interest were in the area of bulk SiC growth (including large-diameter crystals), modeling, characterization, homo- and heteroepitaxial growth (e.g., doping control, morphology development, and carrier lifetimes), advances in ion implantation, improved ohmic and rectifying contacts, surfaces and interfaces, oxidation, and alternative dielectric materials and devices (including high-voltage, high-temperature, high-frequency sensors and system level benefits).

DTIC

Epitaxy; Growth; Dielectrics; Crystals; Silicon Carbides

20030067390 Tulane Univ., New Orleans, LA, USA

Proton-Exchange Membranes from Sulfonated Polyphosphazene Blends

Pintauro, Peter N.; Wycisk, Ryszard; Carter, Roy; Yoo, H.; Lee, J.; April 04, 2003; 13 pp.; In English

Contract(s)/Grant(s): DAAD19-00-1-0517

Report No.(s): AD-A414518; ARO-41074.2-CH; No Copyright; Avail: CASI; [A03](#), Hardcopy

Proton-exchange membranes for direct methanol fuel cells were prepared from sulfonated polyBIS(3-METHYLPHENOXY)PHOSPHAZENE, which was blended with either Kynar (TM) Flex, polyacrylonitrile, or polybenzimidazole. In some cases the blended films were UV-crosslinked. The proton conductivity of the membranes was sufficiently high for fuel cell applications. The water swelling of the membranes was generally greater than that of Nafion 117, but the methanol crossover was lower than that of Nafion 117. Direct liquid methanol fuel cell tests were performed with MEAs fabricated with UV-crosslinked membranes containing sulfonated polyBIS(3-METHYLPHENOXY)PHOSPHAZENE and polyacrylonitrile (crosslinking was carried out using benzophenone as the photo-initiator). MEAs worked best when a high ion-exchange capacity (high conductivity) polyphosphazene membrane contacted the electrodes in which case the fuel cell power output was nearly the same as that with Nafion 117 (for current densities 0.15 A/sq cm), but the methanol crossover was 3-4-times lower than Nafion. With a three-membrane composite MEA (a lower conductivity methanol-blocking film sandwiched between two high conductivity membranes) there was a significant decrease in crossover (almost ten-times lower

than Nafion 117) with a modest decrease in the fuel cell's current-voltage behavior.

DTIC

Membranes; Phosphazene; Fuel Cells; Methyl Alcohol

20030067395 Engineering Research And Consulting Inc(ERC Inc) Edwards AFB, CA, Edwards AFB, CA, USA

The Effect of Pressure and Acoustic Excitation on Coaxial LN₂/GN₂ Jets

Davis, D.; Chehroudi, B.; Talley, D.; May 6, 2003; 4 pp.; In English

Contract(s)/Grant(s): Proj-2308

Report No.(s): AD-A414575; AFRL-PR-ED-AB-2003-124; No Copyright; Avail: CASI; [A01](#), Hardcopy

The present trend in liquid rocket engines, gas turbines, and Diesel engines, is towards increasingly higher chamber pressures. In many cases, the chamber pressure can exceed the critical pressures of the fuel or oxidant. Above the critical pressure, the distinction between the gas and liquid phases is lost, and mechanisms conventionally associated with subcritical spray combustion no longer necessarily apply. Until recently, relatively little has been understood about the injection and combustion behavior of propellants at supercritical chamber pressures. The results presented here are an extension of our previous work, systematically investigating liquid rocket injector behavior at subcritical and supercritical pressures.

DTIC

Combustion Chambers; Propellant Combustion; Liquid Propellant Rocket Engines

20030067397 Boeing North American Inc Canoga Park CA Rocketdyne Div., Canoga Park, CA, USA

ALCAN Can-Do: Advanced Propulsion Development Engine Nails First-Round Testing

Unkeless, Susie; Apr. 23, 2003; 4 pp.; In English

Contract(s)/Grant(s): F04611-02-C-0002; Proj-4847

Report No.(s): AD-A414585; AFRL-PR-ED-PR-2003-127; No Copyright; Avail: CASI; [A01](#), Hardcopy

As part of the Advanced Lightweight Chamber and Nozzle (ALCAN) program, over 50 hot fire tests were run in the Mojave desert over a wide range of pressures and mixture ratios in February and March. These proof-of-concept engines are designed to perhaps one day produce a booster-sized engine weighing half as much as the SSME, with increased performance. The first round of tests, conducted at Rocketdyne's Mojave Test Area, were intended to prove the viability of the concept, according to Rocketdyne's Program Manager Scott Claflin. 'In other words, we were trying to prove that we could efficiently operate a combustion chamber with a transpiration cooled ceramic matrix composite (CMC) liner.' Transpiration, a cooling technique in which a very small percentage of the rocket fuel flow is introduced through uniformly distributed pores in the combustion chamber wall, is similar to what happens when humans perspire.

DTIC

Combustion Chambers; Liquid Propellant Rocket Engines

20030067429 Northwestern Univ., Evanston, IL

Enhanced Electromagnetic and Chemical/Biological Sensing. Properties of Atomic Cluster-Derived Materials

Schatz, George C.; DeHeer, Walter; Hupp, Joseph; Jarrold, Martin; Ketterson, John; Feb. 24, 2003; 42 pp.; In English;

Original contains color illustrations

Contract(s)/Grant(s): DAAG55-97-1-0133

Report No.(s): AD-A414259; ARO-37257-MUR; No Copyright; Avail: CASI; [A03](#), Hardcopy

The Center for Atomic Clusters-derived Materials performed a broad range of research concerned with synthesizing, characterizing and utilizing atomic and molecular clusters, nanoparticles and nanomaterials. Our most important result was the development of a nanoparticle-based technology for DNA detection that has now been commercialized, and which holds the promise of revolutionizing this field. A second important result was the development of a method for chemical and biological agent detection based on localized surface plasmon absorption. Other projects included the structural characterization of atomic clusters of all of the group 14 elements, important developments in carbon nanotube conductivity and mechanical properties, advances in optical property theory, electronic conductivity theory and the theory of DNA melting, new methods of synthesis of metal nanoparticles and nanoparticles that are coated with organics and/or DNA, the first observation of nonlinear optical properties such as HYPER-Rayleigh scattering for nanoparticles, and the synthesis and characterization of new classes of magnetic nanoparticles. Fourteen students received Ph.D. degrees, and most are now employed in industry.

DTIC

Atomic Clusters; Synthesis (Chemistry); Molecular Clusters; Detection

20030067431 Academy of Sciences (USSR), Novosibirsk, USSR

Chemistry of Destroying of Organophosphorus Compounds in Flame and Mechanism of Their Action as Fire Suppressants

Korobeinichev, Oleg P.; Shmakov, Andrey G.; Shvartsberg, Vladimir M.; Bolshova, Tatyana A.; Mar. 31, 2002; 50 pp.; In English

Contract(s)/Grant(s): DAAD19-00-1-0136

Report No.(s): AD-A414452; No Copyright; Avail: CASI; [A03](#), Hardcopy

The structure of atmospheric lean ($\phi=0.8$) and rich ($\phi=1.2$) $\text{CH}_4/\text{O}_2/\text{Ar}$ and $\text{C}_3\text{H}_8/\text{O}_2/\text{Ar}$ flames doped with trimethylphosphate (TMP) was studied by molecular beam mass spectrometry (MBMS) and modeling. Methodic difficulties of MBMS measurement of the structure of atmospheric flames were analyzed and recommendations were elaborated. An influence of TMP additive on the structure of atmospheric flames was demonstrated. A strong influence of equivalence ratio of a flame on the concentration of PO, PO_2 , HOPO, HOPO₂ and OP(OH)₃ has been observed. The influence of TMP additive on concentration of H, OH, CH₃ was investigated. TMP loading dependencies of burning velocity of a stoichiometric CH_4/air and $\text{C}_3\text{H}_8/\text{air}$ flames were measured and simulated. TMP and triethylphosphate loading dependence of normalized extinction strain rate of opposed-jet $\text{CH}_4/\text{O}_2/\text{N}_2$ flame was measured. Both OPC demonstrated close fire suppression effectiveness. Comparison of the experimental data with results of modeling on flame structure and burning velocity made it possible to reveal essential drawbacks of our kinetic model proposed early and noticeably refine it. The published models of Glaude et al. and Babushok and Tsang were tested by comparing measured and simulated concentrations of phosphorus containing flame species. In order to make the mechanism to predict better both the flame structure and burning velocity rate constants of eight the most important reactions from Twarowski mechanism have been modified. The possible reasons of the failure of the models to predict the structure of the rich flames were analyzed and perspectives of future research were discussed.

DTIC

Chemistry; Flames; Organic Phosphorus Compounds; Methyl Compounds; Extinction

20030067441 Minnesota Univ., Minneapolis, MN

Modeling the Hydrolysis of Phosphonate and Phosphate Esters

Cramer, Christopher J.; Feb. 22, 2001; 7 pp.; In English

Contract(s)/Grant(s): DAAH04-96-1-0424

Report No.(s): AD-A414307; No Copyright; Avail: CASI; [A02](#), Hardcopy

We proposed to develop and apply new computational chemistry techniques for predicting the structure and reactivity of phosphorus-containing compounds in aqueous solution. Early efforts were to: (1) refine a basis set that optimally balances efficiency and flexibility for ab initio calculations on molecules containing phosphorus, (2) extend our quantum mechanical Generalized Born/ Surface Tension continuum solvation models (the SMx series of models) to ab initio self-consistent field implementations, and (3) begin exploring gas-phase potential energy surfaces for hydrolysis and nucleophilic substitution reactions of phosphonate and phosphate esters and ester derivatives. The intent of the latter effort was to provide potentially useful starting points for calculations including the effect of aqueous solvation, and moreover to permit an evaluation of exactly how important those effects are in controlling structure and reactivity.

DTIC

Esters; Hydrolysis; Phosphates; Models; Phosphorus Compounds

20030067452 Massachusetts Inst. of Tech., Cambridge, MA

The Marine Biogeochemistry of Molybdenum

Tuit, Caroline B.; Feb. 2003; 258 pp.; In English

Contract(s)/Grant(s): OCE-0096453; DGE-9454129

Report No.(s): AD-A414331; MIT/WHOI-2003-05; No Copyright; Avail: CASI; [A12](#), Hardcopy

Prevailing wisdom holds that the vertical distribution of molybdenum (Mo) in the open ocean is conservative, despite Mo's important biological role and association with Mn oxides and anoxic sediments. A high precision ($\pm 0.5\%$) isotope dilution ICP-MS method for measuring Mo was developed to re-evaluate the marine distribution of Mo in the dissolved and particulate phase. Dissolved Mo profiles of the Eastern Tropical Pacific showed both depletion and enrichment of dissolved Mo possibly associated with interaction of Mo with coastal sediments. Dissolved Mo profiles in several California Borderland Basins showed 1-2 nM Mo depletions below sill depth.

DTIC

Molybdenum; Geochemistry

20030067454 Air Force Inst. of Tech., Wright-Patterson AFB, OH

Electrical Activation Studies of Silicon Implanted Al(x)Ga(1-x)N and Coimplanted GaN

Chitwood, Elizabeth A.; Mar. 2003; 75 pp.; In English; Original contains color illustrations

Report No.(s): AD-A414327; AFIT/GAP/ENP/03-01; No Copyright; Avail: CASI; [A04](#), Hardcopy

A comprehensive study of the electrical activation of silicon implanted Al(x)Ga(1-x)N was performed as a function ion dose, anneal temperature, and aluminum mole fraction. Also, GaN coimplanted with silicon and nitrogen was investigated. Room temperature Hall effect measurements were used to determine carrier concentration and mobility. All the samples had a 500 angstrom encapsulant of AlN, and were implanted at room temperature with 200 keV silicon ions at doses ranging from 1×10^{13} to 1×10^{15} /sq cm. The GaN was also implanted with nitrogen under the same conditions in doses of 9×10^{12} to 9×10^{14} /sq cm, respectively. The samples were annealed at temperatures ranging from 1200 to 1350 degrees C for 30 to 120 seconds in a flowing nitrogen environment. The aluminum mole fractions considered were 0.2 and 0.3. The electrical activation efficiency for the Al(0.2)Ga(0.8)N annealed at 1350 degrees C and implanted with 1×10^{15} /sq cm was almost 90%. While the Al(0.3)Ga(0.7)N annealed at 1350 degrees C and implanted with 1×10^{15} /sq cm exhibited only about 42% activation. The activation efficiency for all the samples increased with anneal temperature, but decreased with aluminum mole fraction. The mobilities and the carrier concentrations demonstrate an increase with the anneal temperature. Although the Al(0.2)Ga(0.8)N exhibited almost perfect activation, the mobility was generally low, only 50 /sq cm/Vxs. The coimplanted GaN showed surprisingly poor results. The highest activation efficiency was only 37% for the sample annealed at 1300 degrees C and implanted with a dose of 1×10^{15} silicon ions /sq cm. The mobilities for these samples were high, on average 100 /sq cm/Vxs. The carrier concentration and activation efficiency were found to increase with implanted dose. The mobilities, however, decreased as the anneal temperature increased.

DTIC

Silicon; Activation; Photoluminescence; Electrical Properties; Ion Implantation; Gallium Nitrides

20030067478 Stanford Univ., Stanford, CA

Application of Cavity Ring-Down Spectroscopy to Liquid Samples

Zare, Richard N.; May 15, 2003; 7 pp.; In English

Contract(s)/Grant(s): N00014-00-1-0364

Report No.(s): AD-A414354; SPO-23093; No Copyright; Avail: CASI; [A02](#), Hardcopy

Three main strategies in the application of CRDS to liquids have been investigated. In the direct liquid approach, an enclosed cavity is entirely filled with liquid for the purpose of quantifying low concentrations of solutes in a bulk solution and monitoring reactions in solution. A picomolar detection limit for a strongly absorbing solute in acetonitrile has been demonstrated, and interesting kinetic behavior has been observed at low concentrations. In the Brewster's angle flow cell implementation, a specially designed sample cell is placed within an optical cavity and used to detect low concentration species in small volume aqueous samples either statically or in a flow. It has been successfully coupled to liquid chromatography and promises to surpass commercial UV-Vis detectors in sensitivity. In evanescent wave CRDS, a prism is placed within the optical cavity such that light undergoes total internal reflection within the prism, and the resulting evanescent wave is employed to probe optical absorption at the glass-water interface. This technique has been used to investigate cation adsorption to the interface and may have applications as an ultrasensitive detector of anionic surfactants.

DTIC

Liquid Chromatography; Spectroscopy; Cavities; Radiation Absorption; Sampling

20030067496 TRW Space and Electronics Group, Redondo Beach, CA

Laboratory Studies of Al(2)O(3)-NO(x) Aerosols

Disselkamp, Robert; Edwards, John R.; Pilson, Daniel; Smith, Tyrrel W., Jr.; Sep. 30, 1999; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F09603-95-D-0176-0007

Report No.(s): AD-A414405; No Copyright; Avail: CASI; [A03](#), Hardcopy

Laboratory experiments were performed to investigate the chemistry of aluminum oxide (gamma Al(2)O(3)) aerosol samples upon exposure to NO(x) (NO(x) is NO, NO(2), etc.) gases. Static aerosol samples were generated in an aerosol chamber and studied at temperatures ranging from 298 to 183 K. Fourier-transform infrared (FTIR) absorption spectroscopy was used to study the aerosol samples over time. Each aerosol was created using the same procedure. First, a reactant gas species, NO or NO(2), was added to the chamber and infrared spectra were collected over a 20-minute time interval to characterize heterogeneous reactions occurring on the chamber walls. Next, an aluminum oxide aerosol was generated by expanding powder into the chamber using nitrogen gas at high pressure. Infrared spectra were then collected at 6-minute

intervals for at least 100 minutes to characterize Al(2)O(3)-NO(x) chemistry. The experiments reported on in this paper enabled a quantitative characterization of both the rate of reactant gas uptake and product formation processes to be performed. A quantitative (i.e., stoichiometric) analysis of reactant gas depletion and product gas formation enabled elementary reactions involving aluminum oxide surface hydroxyl sites and NO(x) species to be proposed.

DTIC

Aerosols; Aluminum Oxides; Infrared Spectra; Nitrogen Oxides; Contaminants; Atmospheric Chemistry

20030067511 Utah Univ., Salt Lake City, UT

Cluster Ion Beam Studies of Fundamental Dynamics Related to Physical Deposition; Kinematic Sample Mounting System for Accurate Positioning of Transferrable Samples; Sintering, Oxidation, and Chemical Properties of Size-Selected Nickel Clusters on T

Anderson, Scott L.; Lapicki, Adam; Boyd, Kevin J.; Lee, Sungsik; Aizawa, Masato; Nov. 2002; 83 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0138

Report No.(s): AD-A413478; AFRL-SR-AR-TR-03-0107; No Copyright; Avail: CASI; [A05](#), Hardcopy

This final report and the three journal articles following it support the complementary scientific goals of both AFOSR and DOE: stable catalysts for monopropellant decomposition, and the effects of cluster size and support defects on catalytic activity and selectivity, respectively. With the agreement of AFOSR, the original DOE effort was refocused on cluster deposition as a means to prepare and study model catalysts composed of size-selected clusters on oxide supports. The objectives were to probe the effects of cluster size, substrate structure, and deposition conditions on catalytic activity. The focus was on catalysts for monopropellant decomposition in spacecraft thrusters. During the first half of the grant period instrument upgrades were conducted to support the catalysis experiments. These upgrades included improvements in the cluster deposition beamline, addition of low energy ion scattering spectroscopy (ISS), addition of Auger electron spectroscopy (AES), and the redesign of sample holders and TPD station. The first experiment focused on the use of ISS to characterize size-selected deposited clusters by studying Ni(n)/TiO₂ samples. The effects of deposition energy and support preparation conditions on the oxidation side of the clusters were examined by x-ray photoelectron spectroscopy (XPS). ISS was used to characterize the dispersion of Ni on the support and provide insight into binding morphology. The second study used iridium as the catalyst of choice for monopropellant decomposition with rutile TiO₂ as the initial substrate. Experiments also were conducted on XPS, ISS, C(superscript 16)O and C(superscript 18)O adsorption and desorption behavior to characterize deposited iridium clusters, the adsorption of adventitious CO on Ir(n)/TiO₂ samples, and CO TPD from Ir₂ and Ir₁₀ following different CO exposure sequences. (10 figures, 36 refs.)

DTIC

Deposition; Catalysis; Decomposition; Monopropellants

20030067631 Fluor Daniel Hanford, Inc., Richland, WA, USA

Flash Rust and Waterjetting Study

Dorsh, P. M.; Nov. 14, 2001; 13 pp.; In English

Report No.(s): DE2003-807507; RPP-8857; No Copyright; Avail: Department of Energy Information Bridge

Certain areas of the primary wall in the AY-101 tank annulus are being cleaned with a remotely operated waterjet. There is some concern on how it will effect the surface of the tank wall after cleaning and how to prevent rust and corrosion from developing on the wall in the future. This study addresses the cause and effects of flash rust, which typically develops on steel surfaces after the waterjetting process.

NTIS

Steels; Corrosion; Tanks (Containers)

20030067634 Cornell Univ., Ithaca, NY, USA, California Inst. of Tech., Pasadena, CA

Advanced Chemistry Basins Model

Jan. 2001; 18 pp.; In English

Report No.(s): DE2003-807772; No Copyright; Avail: Department of Energy Information Bridge

The advanced Chemistry Basin Model project has been operative for 18 months. A number of tasks are reported on. The first task is to Develop a database of additional and better maturity indicators for paleo-heat flow calibration. The second task is to Develop maturation models capable of predicting the chemical composition of hydrocarbons produced by a specific kerogen as a function of maturity, heating rate, etc.; assemble a compositional kinetic database of representative kerogens. The third task of the project is to Develop a 4 phase equation of state-flash model that can define the physical properties (viscosity,

density, etc.) of the products of kerogen maturation, and phase transitions that occur along secondary migration pathways. The fourth task of the project is to Build a conventional basin model and incorporate new maturity indicators and data bases in a user-friendly way. The fifth task of the project is to Develop an algorithm which combines the volume change and viscosities of the compositional maturation model to predict the chemistry of the hydrocarbons that will be expelled from the kerogen to the secondary migration pathways. The sixth task of the project is to Develop an algorithm that predicts the flow of hydrocarbons along secondary migration pathways, accounts for mixing of miscible hydrocarbon components along the pathway, and calculates the phase fractionation that will occur as the hydrocarbons move upward down the geothermal and fluid pressure gradients in the basin. The seventh and final task for the project is to Integrate the above components into a functional model implemented on a PC or low cost workstation.

NTIS

Petrology; Geochemistry; Basins (Containers); Petroleum Products; Computer Programs; Models

26

METALS AND METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

20030066279 Sandia National Labs., Albuquerque, NM

Environmental Management Science Program. Optimization of Thermochemical, Kinetic, and Electrochemical Factors Governing Partitioning of Radionuclides during Melt Decontamination of Radioactively Contaminated Stainless Steel

Van den Avyle, J. A.; Jun. 01, 1998; 7 pp.; In English

Report No.(s): DE2003-13688; No Copyright; Avail: Department of Energy Information Bridge

Melt decontamination of radioactive scrap metal could convert a disposal liability into a final product that would reduce the total volume of material necessary for burial and save substantial material costs. The goal of this project is to optimize a melt decontamination process through a basic understanding of the factors which govern the partitioning of various radionuclides between metal, slag, and gas phases. Radionuclides which are captured by a slag phase may be stabilized by promoting the formation of synthetic minerals within a leach resistant matrix. The main focus of this project is the application of electroslog remelting (ESR) toward cleanup of surface contaminated stainless steels.

NTIS

Stainless Steels; Radioactive Wastes; Recycling

20030067223 Johns Hopkins Univ., Baltimore, MD

Structure and Dynamics of Shear Bands in Metallic Glasses and Nanophase Composites

Hufnagel, Todd C.; Feb. 6, 2003; 15 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0487

Report No.(s): AD-A413556; No Copyright; Avail: CASI; [A03](#), Hardcopy

We have performed quantitative high-resolution transmission electron microscopy studies of the structure of shear bands in metallic glasses. We observe the formation of numerous nanometer-scale voids in shear bands produced under predominantly tensile loading. These void-like defects appear to result from the coalescence of excess free volume in the active shear band when the plastic flow ceases. By comparing the free energy of the shear band with that of the undeformed glass, we show that the void formation process is thermodynamically possible. The presence of the voids can explain several features of the mechanical behavior of metallic glasses, including the difference in plastic strain observed between tests conducted in uniaxial tension and those done in uniaxial compression.

DTIC

Metals; Glass; Shear Properties; Composite Materials; Defects

20030067298 University of Southern California, Los Angeles, CA

Sensing of Neuron Signals Using Microelectromechanical Systems

Baudry, Michel; Berger, Theodore W.; Kim, Eun Sok; McKenna, Charles E.; Thompson, Mark E.; Mar. 6, 2003; 11 pp.; In English

Contract(s)/Grant(s): N00014-01-1-0479

Report No.(s): AD-A414552; No Copyright; Avail: CASI; [A03](#), Hardcopy

The goal of our program was to access the viability of using MEMS devices to detect firing signatures from neurons. In

order to evaluate these devices we needed to prepare and test MEMS devices biologically relevant situations and develop systems that will be sensitive to the rising and falling levels of potassium, present during neural activity. Several different MEMS structures were tested and one was found that gave a measurable resonance signal in water with ionic strength comparable to biological systems. The MEMS device showed efficient cation binding, however it was not selective to potassium. A potassium specific crown ether surface treatment was applied to the MEMS device, however this surface treatment did not lead to selective potassium binding. We are currently examining the surface coating to determine if the crown ether density was too low for efficient potassium binding. In a parallel effort we have developed methods for selective cell binding to TiN surface. Cell adhesion molecules were anchored to the TiN surface, promoting the adhesion of dissociated cells.

DTIC

Microelectromechanical Systems; Surface Treatment; Neurons; Adhesion

20030067302 Institute of Industrial Technology TNO, Delft, Netherlands

Vacuum Infusion of Low-Cost Aerospace Composites

Labordus, Maarten; Verhoef, R. C.; Jan. 2002; 26 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F61775-02-WE044

Report No.(s): AD-A414550; No Copyright; Avail: CASI; [A03](#), Hardcopy

This report results from a contract tasking TNO Industrie as follows: A mold system will be designed in which the hydrostatic pressure can be measured in the resin during the vacuum infusion process. Pressure transducers will be mounted in the surface of a flat aluminum plate and data will be digitally recorded. Simple compression tests on dry and impregnated laminate will provide data to relate the pressure gradient (out of plane) to the local laminate thickness. From a combination of the pressure data and the compression data the correction factor on Darcy's Law can empirically be determined. Outputs of the research will be: 1. Empirical quantification of pressure gradient during vacuum infusion and Resin Transfer Molding (RTM); 2. Correction of Darcy's Law; 3. Practical test to measure compressibility of reinforcements and translation of data into above-mentioned correction term.

DTIC

Composite Materials; Vacuum; Resin Transfer Molding; Hydrostatic Pressure

20030067494 Air Force Research Lab., Wright-Patterson AFB, OH

Continuous Dynamic Recrystallization During Friction Stir Welding of High Strength Aluminum Alloys

Jata, K. V.; Semiatin, S. L.; Sep. 2000; 9 pp.; In English

Report No.(s): AD-A414407; AFRL-ML-WP-TP-2003-441; No Copyright; Avail: CASI; [A02](#), Hardcopy

Friction stir welding (FSW) is a solid state joining process 1,2,3 that uses a rapidly-rotating, non-consumable high strength tool-steel pin that extends from a cylindrical shoulder (Figure 1). The workpieces to be joined are firmly clamped to a worktable; the rotating pin is forced with a pre-determined load into them and moved along the desired bond line. Frictional heating is produced from the rubbing of the rotating shoulder with the workpieces, while the rotating pin deforms (i.e. 'stirs') the locally-heated material. To produce a high integrity defect-free weld, process variables (RPM of the shoulder-pin assembly, traverse speed, the downward forging force) and tool pin design must be chosen carefully. FSW can be considered as a hot-working process in which a large amount of deformation is imparted to the workpiece through the rotating pin and the shoulder. Such deformation gives rise to a weld nugget (whose extent is comparable to the diameter of the pin), a thermomechanically-affected region (TMAZ) and a heat-affected zone (HAZ). Frequently, the weld nugget appears to comprise equiaxed, fine, dynamically recrystallized grains whose size is substantially less than that in the parent material. The objective of the present research was to develop a basic understanding of the evolution of microstructure in the dynamically recrystallized region and to relate it to the deformation process variables of strain, strain rate, and temperature. Such a correlation has not been attempted before perhaps because of the difficulty in quantifying the process variables. To overcome such difficulties, recent work 4 to measure and model the local temperature transients during FSW was utilized, and an approximate method was employed to estimate the strain and strain rate in the weld nugget.

DTIC

High Strength Alloys; Recrystallization; Friction Welding

20030067629 Fluor Daniel Hanford, Inc., Richland, WA, USA

Primary Clean Machine Process Validation for Mark IV Fuel and Fuel in Aluminum Canisters Test Plan and Test Specification (OCRWM)

Pitner, A. L.; Oct. 11, 2001; 21 pp.; In English

Report No.(s): DE2003-807484; SNF-8958; No Copyright; Avail: Department of Energy Information Bridge

The purpose of the Primary Clean Machine (PCM) is to reduce the canister particulate loading in a Multi-Canister Overpack (MCO) to ensure that fuel particulate loadings satisfy safety basis requirements. Adequate fuel cleaning can be verified by visually examining each fuel element to be loaded into an MCO basket. However, to reduce the need for visual examination of the fuel, the cleaning process is qualified by demonstrating that fuel is reliably cleaned when the process is controlled and operated under specified conditions. Once qualified, the cleaning process can be operated with only periodic inspection of fuel elements to verify that adequate cleaning is being accomplished.

NTIS

Aluminum; Cans; Fuel Tests; Specifications

27

NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see *24 Composite Materials*.

20030067086 NASA Johnson Space Center, Houston, TX, USA

Diaplectic Glass Content in Experimentally Shock-loaded Quartz Determined by X-Ray Powder Diffraction

Skala, R.; Hoerz, F.; Langenhorst, F.; Third International Conference on Large Meteorite Impacts; August 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations

Contract(s)/Grant(s): HPRI-1999-CT-00004; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Quartz is the most common mineral of terrestrial crustal rocks and thus a widespread indicator for impact cratering and associated shock metamorphism. Planar deformation features (PDFs) are among the most prominent and diagnostic shock features in quartz and they represent thin lamellae of glass that formed via solid-state transformations. This so-called 'diaplectic' glass becomes pervasive at higher pressures and results in optically isotropic and X-ray-amorphous phases that resemble texturally the original quartz grains (without evidence of melt flow). In the past, it has been shown that the amount of this amorphous material in experimentally shock-loaded quartz correlates with peak shock pressure. Both reports derive the glass content from density measurements of individual crystals employing the equation $X(\%) = (\rho(\text{sub } x) - \rho(\text{sub } 0)) / (\rho(\text{sub } x) - \rho(\text{sub } \text{gl}))$, where x and 0 stands for X-ray and average (optical) density, respectively. The density of glass, $\rho(\text{sub } \text{gl})$, was adopted as 2.2 g/cu cm. Though the same procedures had been applied, the resulting glass content differs significantly among the above studies. In the present study, we are using a new approach based solely on the integral intensity of a single, carefully selected reflection in the XRD pattern, and we will compare our data to those reported in the literature.

Author

Shock; Quartz; Glass; Deformation; Chemical Analysis

20030067230 Staten Island Coll NY, Staten Island, NY, USA

Optical Hole Burning of Materials for Frequency Domain Optical Storage and Processing

Gorokhovskiy, Anshel; Mar. 25, 2002; 8 pp.; In English

Contract(s)/Grant(s): F49620-99-1-0192

Report No.(s): AD-A413627; AFRL-SR-AR-TR-03-0118; No Copyright; Avail: CASI; [A02](#), Hardcopy

Over the report period, an optical laboratory for characterization materials for frequency domain optical storage was upgraded. Spectral and spectral hole burning properties were studied for several free-based and metallo-naphthalocyanine derivatives in polymer hosts. These materials exhibit a strong 0-0 absorption band and persistent hole burning in the region 800 nm. Hole burning parameters were determined for eight materials; in particular, the hole burning kinetics was analyzed and the quantum efficiencies were determined to be between 0.1% and 1%. Holograms (data pages) in the transmission geometry were successfully recorded in the materials studied using single frequency laser diodes. A photoluminescence of five natural diamonds (type Ia) implanted with Xe ions with dose range 1×10^{13} - 5×10^{14} /sq cm was investigated as a function of thermal annealing at temperatures between 300 and 1400 C.

DTIC

Hole Burning; Frequency Domain Analysis; Optical Memory (Data Storage); Data Processing; Data Transmission; Optical Properties

20030067303 Western Kentucky Univ Bowling Green Dept. Of Chemistry, Bowling Green, KY, USA
A Study of the Thermal Stability, Degradation Mechanisms and Properties of Polymer/Organically Modified Layered Silicate Nanocomposites

Pan, Wei-Ping; Riley, John T.; Lee, Charles W.; Mar. 2003; 97 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0260; Proj-3484

Report No.(s): AD-A414556; 512401; AFRL-SR-AR-TR-03-0202; No Copyright; Avail: CASI; [A05](#), Hardcopy

PS-MMT nanocomposites were prepared via suspension free radical polymerization of styrene in the dispersed organo-MMT. The results of XRD and TEM indicated that exfoliated nanocomposites were achieved. The effect of surfactants on the properties of then synthesized nanocomposites was studied. It is found that PS_MMT nanocomposite with 5% wt% of organo-MMT gave the greatest improvement in the thermal stability, and PS-MMT nanocomposites with 7.5% of organo-MMT showed the greatest improvement in mechanical properties, comparing with that of pure PS in our experimental conditions. The alkyl chain length of surfactant used in fabricating organo-MMT affects the synthesized PS nanocomposites, the longer the alkyl chain length that the surfactant possesses, the higher glass transition temperature PS nanocomposite. It is found that the organoclay in the nanocomposites seems to play a dual role: (a) as nanofiller leading to the increase of storage modulus and (b) as plasticizer leading to the decrease of storage modulus.

DTIC

Degradation; Polymers; Thermal Stability; Silicates; Plasticizers

20030067305 Bioelastics Research Ltd., Birmingham, AL
Elastomeric Polypeptides as Acoustic Absorbers for Navy Applications

Urry, Dan W.; Xu, Jie; Wang, Weijun; Hayes, Larry C.; Prochazka, Frederic; Parker, Timothy M.; May 2003; 114 pp.; In English

Contract(s)/Grant(s): N00014-00-C-0404; N00014-00-C-0178

Report No.(s): AD-A414561; BRL-0012; No Copyright; Avail: CASI; [A06](#), Hardcopy

Elastic protein n-based polymers comprised of repeating pentapeptide sequences, (GXGXP)(n), exhibit mechanical resonances that have been observed to date with frequency maxima near 5 MHz and 3 kHz. Because the 3 kHz resonance is in the middle of the acoustic frequency range, the purpose here is to substantiate the relevance of the 3 kHz resonance to acoustic absorption and to demonstrate means of improving mechanical properties for the sound absorption application. Previously reported loss factor data in the 100 Hz to 10 kHz range is substantiated by relevant but distinctly different measurements of loss shear modulus and loss permittivity. Furthermore cross-linking approaches are reported that result in increase elastic moduli by an order of magnitude to $4 \times 10^{(exp 6)}$ Pa at 20% strain and that increase break stress by two orders of magnitude to $1.3 \times 10^{(exp 7)}$ Pa while exhibiting break strain values of several hundred per cent.

DTIC

Peptides; Polymers; Acoustic Attenuation; Absorptivity

20030067308 Hawaii Univ., Honolulu, HI
Azulenic Chromophores For Optical Limiting and Other Nonlinear Optical Applications

Asato, Alfred E.; Liu, Robert S.; Apr. 22, 2003; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-99-1-0295

Report No.(s): AD-A414484; ARO-40286.7-CH-SAH; No Copyright; Avail: CASI; [A03](#), Hardcopy

We summarize our studies of the chemical, photophysical, optical limiting, and other nonlinear optical properties of long wavelength-absorbing azulene derivatives; namely, fluorinated azulenes, azulenic donor-acceptor molecules, and reverse saturable absorber azulenic symmetrical dye chromophores. The effect of fluorine and other substituents on the excited singlet state properties of azulene and, in particular, the enhancement of first excited state lifetimes and fluorescence quantum yields was investigated. Both Hyper-Raleigh Scattering and Resonance Raman measurements of azulenic donor-acceptor chromophores revealed the involvement of more than one excited state in the lowest energy electronic transitions contrary to accepted models. An ultrafast transient absorption spectroscopic study of a series of guaiazulenic polymethine dyes indicated the presence of several discrete short-lived excited singlet state species that absorb over the entire visible region. A ring-locked azulenic dye dimer formed at low temperature and was studied by variable temperature NMR. Optical quality polymer films of azulenic dyes were prepared by doping and, in one case, by a novel chemical transformation of the polymer host. Unexpected thermochromic behavior was observed for a trimethine dye. A novel series of cross-conjugated azulene derivatives, potentially useful as two-photon absorbers, was also prepared.

DTIC

Chromophores; Optical Properties; Nonlinear Systems; Chemical Properties; Azulene; Optical Materials

20030067385 California Inst. of Tech., Pasadena, CA

Stress Effects in Bulk Metallic Glasses

Ustundag, Ersan; Oct. 29, 2001; 7 pp.; In English

Contract(s)/Grant(s): DAAD19-00-1-0379

Report No.(s): AD-A414601; ARO-40063.7-MS; No Copyright; Avail: CASI; [A02](#), Hardcopy

This project initiated a systematic study of the internal stresses in bulk metallic glasses. It involved internal stresses due to interactions between reinforcements and matrix in bulk metallic glass composites as well as residual stresses due to the thermal tempering of bulk metallic glasses.

DTIC

Metals; Glass; Residual Stress; Metallic Glasses

20030067475

Adhesion Performance of Modified Soy Protein Adhesive

Sun, X. S.; Wang, Donghai; Zhong, Zhikai; Jan. 2001; 9 pp.; In English

Contract(s)/Grant(s): DAAD19-01-1-0570

Report No.(s): AD-A414303; 12481; ARO-42445.1-CH-II; No Copyright; Avail: CASI; [A02](#), Hardcopy

There were two objectives for this research. One was to study the water resistance of various modified soy protein adhesives on fiberboard as packaging box. The other was to investigate the effect of drying temperature on the adhesive performance of the soy protein.

DTIC

Adhesives; Proteins

20030067492

Investigating Cumulative Damage in a Highly Filled Polymeric Material

Liu, C. T.; May 29, 2001; 14 pp.; In English

Contract(s)/Grant(s): Proj-2302

Report No.(s): AD-A412967; AFRL-PR-ED-VG-2001-124; No Copyright; Avail: CASI; [A03](#), Hardcopy

Objectives: 1) Investigate the effects of strain rate and cyclic loading on cumulative damage in a highly filled polymeric material. 2) Determine the relationship between the NDE damage parameter and material properties.

DTIC

Cumulative Damage; Polymers; Composite Materials; Structural Strain; Fracture Mechanics

20030067498 NASA Glenn Research Center, Cleveland, OH, USA

Proceedings of the Seventh Applied Diamond Conference/Third Frontier Carbon Technology Joint Conference (ADC/FCT 2003), Supplement 1

Murakawa, M., Editor; Miyoshi, K., Editor; Koga, Y., Editor; Schaefer, L., Editor; Tzeng, Y., Editor; August 2003; 22 pp.; In English; Seventh Applied Diamond Conference, 18-21 August 2003, Tsukuba, Japan; See also 20030067499 - 20030067500; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 22-708-31-14

Report No.(s): NASA/CP-2003-212319/SUPPL1; E-13906-1/SUPPL1; NAS 1.55:212319/SUPPL1; Copyright; Avail: CASI; [A03](#), Hardcopy

This document contains 2 reports which were presented at the Seventh Applied Diamond Conference/Third Frontier Carbon Technology Joint Conference. The topics discuss the formation of C-N nanofibers as well as the characterization of diamond thin films.

CASI

Conferences; Diamond Films

20030067499 Centre National de la Recherche Scientifique, France

Characterization of <111> Diamond Thin Films by Micro-Raman Spectroscopy

Mermoux, M.; Tajani, A.; Marcus, B.; Bustarret, E.; Gheeraert, E.; Nesladek, M.; Koizumi, S.; Proceedings of the Seventh Applied Diamond Conference/Third Frontier Carbon Technology Joint Conference (ADC/FCT 2003), Supplement 1; August 2003, pp. 7; In English; See also 20030067498; Original contains black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Homoepitaxial growth on <111> oriented synthetic type Ib surfaces has been so far the most successful way to an efficient n-type doping of diamond by using phosphorus. However, such epilayers often present stress-relieving macroscopical cracks, which hamper their application as p-n diodes and other electronic devices. High-resolution confocal micro-Raman spectroscopy results described in this work show that for this particular growth direction the zone-centre phonon peak of the phosphorus-doped epilayers occurs a few cm⁻¹ below the peak of the relaxed diamond, indicating a strong tensile strain present in undoped films as well. Surface frequency mappings indicate that this strain is locally relaxed near the cracks that originate from the film/substrate interface. In-depth frequency cross sections show that close to this interface the substrate is under compressive strain and has a perturbed Raman signature under the cracks. Correlated maps of the spectral features associated to specific defects such as disordered carbon phases or nitrogen and silicon incorporation, give some evidences for the origin of the tensile strain in the layers. This study is performed on n-type phosphorus-doped films grown by CVD in three different laboratories. Comparison of Raman data allows us to discuss the influence on the residual internal strain of various deposition parameters such as the substrate surface quality, the gas pressure, the growth temperature and the purity of the active gases.

Author

Crystal Growth; Diamond Films; Phosphorus

20030067500 Technological Inst. for Superhard and Novel Carbon Materials, Troitsk, Russia

Formation of C-N Nanofibers in High Isostatic Pressure Apparatus and Their Field Emission Properties

Blank, V. D.; Batov, D. V.; Buga, S. G.; Kulnitskiy, B. A.; Polyakov, E. V.; Nahm, Sahn; Lee, Yun-Hi; Bangert, U.; Gutierrez-Sosa, A.; Harvey, A. J., et al.; Proceedings of the Seventh Applied Diamond Conference/Third Frontier Carbon Technology Joint Conference (ADC/FCT 2003), Supplement 1; August 2003, pp. 1-6; In English; See also 20030067498; Original contains color and black and white illustrations

Contract(s)/Grant(s): INTAS Proj. 00-237; Copyright; Avail: CASI; [A02](#), Hardcopy

Carbon-nitrogen (CN) nanofibers have been formed in High Isostatic Pressure (HIP) apparatus in 1:1 nitrogen-argon gas mixture at 75 GPa using graphite electrical heater. Bamboo-like, beads-like, corrugated and spring-like nanofibers with the diameter of about 100-150 nm and the length over 10 micrometers have been found in a deposit with a low content of amorphous carbon. The nitrogen content up to 8.5 % was found in fibers by EELS analysis. The CN nanofibers were printed on cathode plate and the diode-type flat vacuum lamp with 1 inch diagonal was assembled for the field emission study with the gap between anode and cathode varying in the range of 300 900 micrometers. The turn-on fields were about 1.3 V/micrometers, the current density was 0.05 mA/cm² at 1.35 V/micrometers. The time reliability and light emission test were carried out for above 100 hours. We suggest that CN nanofibers can be applied to the high brightness flat lamp because of low turn-on field and time reliability.

Author

Field Emission; Carbon Fibers; Nanostructure Growth; Nitrogen

28

PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power*; *20 Spacecraft Propulsion and Power*; and *44 Energy Production and Conversion*.

20030066259 Johns Hopkins Univ., Baltimore, MD

Prediction of Cellular Dysfunction from Exposure to JP-8

Risby, Terence H.; Apr. 23, 2003; 41 pp.; In English

Contract(s)/Grant(s): F49620-98-1-0403; Proj-2312

Report No.(s): AD-A414170; AFRL-SR-AR-TR-03-0172; No Copyright; Avail: CASI; [A03](#), Hardcopy

During this past 4.5 years, research has been conducted with support from the Air Force Office of Scientific Research. This research has been focused upon assessing the health effects of exposure to jet fuel, JP-8 in military personnel. In addition, research has continued into identifying molecules in exhaled breath that serve as sentinels of exposure, susceptibility and disease. Exhaled breath is composed of many molecules in the gaseous matrix that consists of oxygen, nitrogen, water vapor carbon dioxide and the inert gases Endogenously produced molecules are present in concentrations that are less than 100 parts per billion (v/v) whereas the concentrations of exogenous molecules are dependent upon the exposure concentration. Another important factor is that the composition of exhaled breath changes throughout the normal breathing cycle The sources of

endogenous molecules in exhaled breath may be systemic tissues or cells found at the alveolar membrane junction, in conducting airway, or in the oral-nasal-pharyngeal cavity. The sources of exogenous molecules in exhaled breath may be from previous or current inspiratory air.

DTIC

Jet Engine Fuels; Exhalation; Cells (Biology)

20030067632 Fluor Daniel Hanford, Inc., Richland, WA, USA

Fire Hazard Analysis for the K Basin Fuel Transfer System Annexes Project, A15

Barilo, N. F.; Nov. 13, 2001; 24 pp.; In English

Report No.(s): DE2003-807515; SNF-8642; No Copyright; Avail: Department of Energy Information Bridge

The purpose of the Fuel Transfer System (FTS) is to move the spent nuclear fuel currently stored in the K East (KE) Basin and transfer it by shielded cask to the K West (KW) Basin. The fuel will then be processed through the existing fuel cleaning and loading system prior to being loaded into Multi-Canister Overpacks (MCO). The FTS operation is considered an intra-facility transfer because the spent fuel will stay within the 100 K area and between the K Basins. This preliminary Fire Hazards Analysis (FHA) for the K Basin FTS Annexes addresses fire hazards or fire-related concerns in accordance with U.S. Department of Energy (DOE) 420.1 (DOE ZOOO), and RLID 420.1 (DOE 1999), resulting from or related to the processes and equipment. It is intended to assess the risk from fire associated within the FTS Annexes to ensure that there are no undue fire hazards to site personnel and the public; the potential for the occurrence of a fire is minimized; process control and safety systems are not damaged by fire or related perils; and property damage from fire and related perils does not exceed an acceptable level.

NTIS

Fires; Nuclear Fuels; Spent Fuels; Structural Basins; Hazards

20030067633 Fluor Daniel Hanford, Inc., Richland, WA, USA

Butene and Carbon Monoxide Flammable Clouds in a Glovebox with Two Hotplates

Piepho, M. G.; Feb. 22, 2002; 52 pp.; In English

Report No.(s): DE2003-807663; HNF-9730; No Copyright; Avail: Department of Energy Information Bridge

Two flammable gases in a glovebox (HC-230C-3) at the Plutonium Finishing Plant (PFP) were modeled to quantify the amount of flammable gas and its spatial location. The two flammable gases are butene (C₄H₈) and carbon monoxide (CO). Butene is a hydrocarbon (C₄H₈) gas that is released from magnesium hydroxide precipitate containing dibutyl-phosphate when sufficiently heated. Carbon monoxide is a flammable gas that is released from precipitate containing oxalic acid when sufficiently heated. The model for calculating butene and carbon monoxide gas concentrations is described in Section 2.0. The scenarios of release with the specific model and parameters are described in Section 3.0. The results of calculations are described in Section 4.0 with the summary and conclusions appearing in Section 5.0.

NTIS

Butenes; Carbon Monoxide; Flammability; Flammable Gases; Gas Composition

29

SPACE PROCESSING

Includes space-based development of materials, compounds, and processes for research or commercial application. Also includes the development of materials and compounds in simulated reduced-gravity environments. For legal aspects of space commercialization see *84 Law, Political Science and Space Policy*.

20030067410 NASA Marshall Space Flight Center, Huntsville, AL, USA

Pore Formation and Mobility Investigation (PFMI): Description and Initial Analysis of Experiments Conducted Aboard the International Space Station

Grugel, R. N.; Anilkumar, A. V.; Lee, C. P.; [2003]; 1 pp.; In English; Fifteenth American Conference on Crystal Growth and Epitaxy (ACCGE), 20-24 Jul. 2003, Keystone, CO, USA; Copyright; Avail: Other Sources; Abstract Only

Flow Visualization experiments on the controlled melting and solidification of succinonitrile were conducted in the glovebox facility of the International Space Station (ISS). The experimental samples were prepared on ground by filling glass tubes, 1 cm ID and approximately 30 cm in length, with pure succinonitrile (SCN) under 450 millibar of nitrogen. Porosity in the samples arose from natural shrinkage, and in some cases by direct insertion of nitrogen bubbles, during solidification of the liquid SCN. The samples were processed in the Pore Formation and Mobility Investigation (PFMI) apparatus that is

placed in the glovebox facility (GBX) aboard the ISS. Experimental processing parameters of temperature gradient and translation speed, as well as camera settings, were remotely monitored and manipulated from the ground Telescience Center (TSC) at the Marshall Space Flight Center. During the experiments, the sample is first subjected to a unidirectional melt back, generally at 10 microns per second, with a constant temperature gradient ahead of the melting interface. The temperatures in the sample are monitored by six in situ thermocouples. Real time visualization of the controlled directional melt back shows bubbles of different sizes initiating at the melt interface and, upon dislodging from the melting solid, migrating at different speeds into the temperature field ahead of them, before coming to rest. The thermocapillary flow field set up in the melt, ahead of the interface, is dramatic in the context of the large bubbles, and plays a major role in dislodging the bubble. A preliminary analysis of the observed bubble formation and mobility during melt back and its implication to future microgravity experiments is presented and discussed.

Author

International Space Station; Mobility; Porosity; Spaceborne Experiments; Microgravity

31

ENGINEERING (GENERAL)

Includes general research topics related to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see *categories 32 through 39*.

20030066341 Air Force Research Lab., Edwards AFB, CA, USA

AFRL Propulsion Directorate Test Facilities

Merrell, Joe; Jan. 3, 2001; 106 pp.; In English

Contract(s)/Grant(s): AF Proj. C1A0

Report No.(s): AD-A412996; AFRL-PR-ED-TP-2001-004; No Copyright; Avail: CASI; [A06](#), Hardcopy

No abstract available

Propulsion; Test Facilities

20030066348 CH2M HILL Hanford Group, Inc., Richland, WA, USA

Flammable Gas Accumulation in Waste Transfer-Associated Structures Engineering Task Plan

Kison, P. F.; Parkman, D. B.; Sutey, M. J.; Dec. 06, 2001; 38 pp.; In English

Report No.(s): DE2003-807588; RPP-9015; No Copyright; Avail: Department of Energy Information Bridge

The purpose of this Engineering Task Plan is to identify engineering activities necessary to complete the evaluation of potential flammable gas hazards in waste transfer-associated structures and to provide direction to correct any deficiencies found during the evaluation.

NTIS

Flammable Gases; Flammability; Storage; Hazardous Wastes

20030066374 National Academy of Sciences - National Research Council, Washington, DC, USA

An Assessment of Precision Time and Time Interval Science and Technology

Jan. 2002; 85 pp.; In English

Report No.(s): AD-A413247; No Copyright; Avail: CASI; [A05](#), Hardcopy

Knowledge of time is essential to precise knowledge of location, and for this reason the Navy, with its need to navigate on the high seas, has historically played an important role in the development and application of advanced time realization and dissemination technologies. Discoveries coming from basic research funded by the Office of Naval Research (ONR) lie at the heart of today's highest performance atomic clocks. Naval Research Laboratory (NRL) expertise played a role in developing the space-qualified atomic clocks that enable the Global Positioning System (GPS), and the U.S. Naval Observatory (USNO) maintains and disseminates the standard of time for all of the Department of Defense (DOD). The Navy has made major investments in most aspects of precision time and time interval (PTTI) science and technology, although specific PTTI-related research has also been funded by the Defense Advanced Research Projects Agency (DARPA) and non-DOD agencies such as the National Science Foundation (NSF), the National Aeronautics and Space Administration (NASA), and the Department of Commerce Navy funding, largely through ONR, has a history of being an early enabler of key new developments. Judicious funding decisions by the Navy particularly by ONR program officers have underpinned most

of the major advances in PTTI science and technology (S&T) in the last 50 years Chapter 1 describes the Navy's contributions to PTTI S&T (hereinafter referred to simply as 'PTTI') in detail.

DTIC

Research And Development; Atomic Clocks; Technology Assessment; Navy

20030067300 Johns Hopkins Univ., Baltimore, MD

Novel Technologies for Ultra-High-Rate Deformations of Materials

Ramesh, K. T.; Mar. 19, 2002; 3 pp.; In English

Contract(s)/Grant(s): DAAD19-01-1-0536

Report No.(s): AD-A414487; ARO-41689.1-MS; No Copyright; Avail: CASI; [A01](#), Hardcopy

In order to investigate the strain-rate dependence of the mechanical behavior over a wide range of strain rates a small version of the Kolsky Bar, called the Desktop Kolsky Bar, has been developed for testing small samples. The results of the experimental and numerical examinations show that this technique can be utilized for measuring the high-rate behavior at strain rates from approximately $10(\text{exp } 3)/\text{s}$ up to approximately $5 \times 10(\text{exp } 4)/\text{s}$. The technique can bridge the capabilities of the conventional Kolsky bar and pressure-shear plate impact techniques, and thus improve our understanding of material behavior at high rates. Our experimental work has all been on the aluminum alloy 6061-T651. While we have been able to obtain both desktop Kolsky bar data at $5 \times 10(\text{exp } 4)/\text{s}$ and pressure-shear plate impact data on this material, we have not as yet been able to obtain overlapping data. The lowest strain rate that we have achieved in the pressure-shear experiment is $8 \times 10(\text{exp } 4)/\text{s}$, rather than the $5 \times 10(\text{exp } 4)/\text{s}$ that needed for direct comparison.

DTIC

Aluminum Alloys; Deformation; Mechanical Properties; Strain Rate

20030067674 Missile Defense Agency, Washington, DC, USA

Prototyping 'Rope-a-Dopes' and Other Pitfalls

Little, Terry; ASK Magazine, No. 13; August 2003, pp. 28-29; In English; See also 20030067672; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

My experience, both first-and second-hand, has been that people have misused prototyping almost as often as they have used it wisely. I will try and cite some of the ways I have seen people abuse the concept.

Author

Engineering; Prototypes

20030067676 Proctor and Gamble Co., Cincinnati, OH, USA

An Old Dog and New Tricks

Cameron, W. Scott; ASK Magazine, No. 13; August 2003, pp. 30-31; In English; See also 20030067672; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

As I approach my 55th birthday, the old adage 'you can't teach an old dog new tricks' keeps coming to mind. I'm not sure why, because I don't feel old and I'm still interested in taking on new challenges and learning new tricks. However, as I mentor new project managers, I am also aware that others may consider me an old dog unable to learn new tricks. To the contrary, the people I mentor continue to teach me new tricks and challenge my assumptions about project management.

Author

Project Management; Learning; Personnel; Age Factor

20030067677 NASA Dryden Flight Research Center, Edwards, CA, USA

Proof of Concept

Bauer, Jeffrey; ASK Magazine, No. 13; August 2003, pp. 26-27; In English; See also 20030067672; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

Back in 2000, one of the potential Mars projects involved delivering and then flying an observation plane over the planet. Among the challenges of the project was the small size of the capsule that was going to be used in order to get the plane to Mars. With the planet's thin atmosphere, a plane would need to have large wings in order to fly efficiently. How could you package a large-winged plane in a small capsule?

Author

Prototypes; Pilotless Aircraft; Mars Missions

COMMUNICATIONS AND RADAR

Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and 17 *Space Communications, Spacecraft Communications, Command and Tracking*; for search and rescue, see 03 *Air Transportation and Safety*; and 16 *Space Transportation and Safety*.

20030066811 California Univ., Los Angeles, CA

2.5 Gb/s Chaotic Optical Communication

Tang, S.; Liu, J. M.; Mar. 21, 2002; 3 pp.; In English

Report No.(s): AD-A413808; No Copyright; Avail: CASI; [A01](#), Hardcopy

Digital signal at 2.5 Gb/s bit-rate has been successfully transmitted in a chaotic communication system. The communication quality and capacity are both shown to be very high with this chaotic pulsing semiconductor laser system, which indicates that chaotic communication with several Gb/s bit-rate is feasible with semiconductor lasers.

DTIC

Semiconductor Lasers; Optical Communication

20030066922 Prediction Systems, Inc., Spring Lake, NJ

Global Information Enterprise Simulation Laboratory (GIESIM Lab)

Cave, William C.; Fikus, John H.; Apr. 2003; 82 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-99-D-0001; AF Proj. 4519

Report No.(s): AD-A413886; AFRL-IF-RS-TR-2003-74; No Copyright; Avail: CASI; [A05](#), Hardcopy

Most large-scale force-level simulations assume perfect communications. The goal of the Global Information Enterprise Simulation (GIESim) Lab is the development of a modeling and simulation framework that bridges these communication gaps. PSI was chosen to participate in the formation of the GIESim Lab. PSI performed several analyses on the requirements and architecture needed to ensure success of the GIESim Lab. Analyses performed by PSI spanned user and application requirements, requirements for generic infrastructure, and a generic approach to model architecture and simulation development needed to cut time and cost of producing valid realizations that met performance needs. To elucidate on the capabilities of General Simulation System (GSS) created by PSI, PSI prepared an in-depth overview of GSS attributes applicable to GIESim. Also, PSI created a model taxonomy to help frame the GIESim models selection process. In addition, PSI demonstrated a multi-simulation environment using HLA and TCP/IP as a proof of concept for the GIESim approach. This multi-simulation demonstration consisted of separate simulations of Emitters, Unattended Ground Sensors, an Integrated Air Defense System (LADS), and an Operations Management System (OMS) for the NFSS Project. PSI suggested several research topics for FY03/04 to ensure the success of the GIESim Lab.

DTIC

Information Systems; Simulation; Communication; Networks; Management Systems

20030066924

Nonlinear Nonlocal Cochlear Models, Multitones, Noises and Masking Thresholds

Xin, Jack; Dec. 30, 2002; 11 pp.; In English

Contract(s)/Grant(s): DAAD19-00-1-0524

Report No.(s): AD-A413900; ARO-41670.2-MA; No Copyright; Avail: CASI; [A03](#), Hardcopy

An important part of voice signal processing is to perform a nonlinear operation along frequency on the short time spectrogram, while the nonlinear adaptation along time is better understood. We developed, computed and analyzed a class of nonlinear nonlocal cochlear models to approximate this nonlinear aspect. The model is mechanical in nature, and outputs the acoustic responses on the basilar membrane. In case of two or three tones, our results are in qualitative agreement with existing data. We prove that the model is well-posed in Sobolev spaces for all time, and admits exact multi-frequency solutions (quasi-periodic in time) if the nonlinearity is cubic and weak enough. We upscale the model output towards modeling psycho-acoustic responses to help direct applications in signal processing based on first principles. For input of tone plus a banded noise, we calibrate the model with absolute masking thresholds (on noise only), then rely on model nonlinearity to capture tonal masking of noise and modified thresholds resulting from their interactions.

DTIC

Speech Recognition; Nonlinearity; Noise Threshold; Masking

20030067146

Near-Far Resistance of Multicarrier CDMA Systems

Yue, Xiaodong; Fan, H. H.; Nov. 2002; 6 pp.; In English

Contract(s)/Grant(s): DAAD19-00-1-0529

Report No.(s): AD-A413716; ARO-40087.8-C1; No Copyright; Avail: CASI; [A02](#), Hardcopy

Multicarrier (MG) CDMA systems have been developed and rapidly gained popularity as they capitalize on both MCM (multicarrier modulation)'s resilience to MUI and direct-sequence (DS) CDMA's robustness against frequency selectivity to mitigate both MUI and the inter-symbol interference (ISI) caused by time dispersive channels. However, the well-known near-far problem in a multiuser setting still places fundamental limitations on the performance of MC-CDMA communication systems, and this issue has been considered by very few papers. In this paper the theoretical near far resistance of the MMSE detector in the uplink MC-CDMA (with and without cyclic prefix (CP)) setting is derived. It turns out that the near-far resistance of MC-CDMA without CP has the same form as that of the DS-CDMA except that the user codes are IFFT transformed. Our formulation for the near-far resistance is applied to either blind or non-blind MMSE detectors. Computer simulations confirm theoretical findings.

DTIC

Code Division Multiple Access; Multichannel Communication

20030067246 Naval Research Lab., Washington, DC

Dragon Warrior Communications Relay Testing Using the K-MAX Helicopter

Tate, David L.; Kapuschansky, Scott A.; Wood, John B.; Apr. 14, 2003; 25 pp.; In English; Original contains color illustrations

Report No.(s): AD-A413652; NRL/FR/5520--0310048; No Copyright; Avail: CASI; [A03](#), Hardcopy

NRL's Communication Systems Branch is developing a communications relay for the Dragon Warrior unmanned aerial vehicle (UAV) that will provide over-the-horizon links for networked data communications through a self-organizing background backbone network using the BAE Systems AN/VRC-99A radio. It will provide wideband TCP/IP services at up to 1 Mbps data rate at ranges up to 50 nmi. Initial flight tests of the equipment were performed using the Kaman Aerospace K-MAX helicopter as a surrogate aircraft. This document reports the results of those tests and the lessons learned.

DTIC

Helicopters; Pilotless Aircraft; Telecommunication; Aircraft Communication; Flight Tests

20030067247 Gestalt, LLC, King of Prussia, PA, USA

Intelligent Mission Controller Node

Perme, David; Eaton, Matthew T.; May 2002; 21 pp.; In English

Contract(s)/Grant(s): F33615-99-C-6003; Proj-4923

Report No.(s): AD-A413588; AFRL-HE-WP-TR-2002-0210; No Copyright; Avail: CASI; [A03](#), Hardcopy

The goal of the Intelligent Mission Controller Node (IMCN) project was to improve the process of translating mission tasks between real-world Command, Control, Communications, Computers, and Intelligence (C4I) systems and Joint Synthetic Battlespace (JSB) simulation environments. Using a rule based expert system, IMCN refines the air mission tasking from the C4I system prior to editing by mission controller personnel who are supporting the simulation exercise. This refinement includes processing the mission tasking by adding equipment loads, performing ingress and egress routing, and resolving data ambiguities. The mission controller can also perform additional refinements to the mission as well as adding new rules to further increase the fidelity of the tasking. The result is increased realism in simulation execution of planned missions and a significant reduction in the time required by man-in-the-loop controllers to process an Air Tasking Order (ATO) prior to insertion into a simulation. Equally important, the feasibility of employing expert system technologies to reason over the entire spectrum of air battlespace components was demonstrated.

DTIC

Management; Command And Control; Intelligence; Warfare

20030067262 Clemson Univ., SC, USA

Instrumentation to Support Research in Wireless Spread Spectrum Communications

Baum, Carl; Jan. 15, 2002; 7 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0329

Report No.(s): AD-A413686; ARO-38135-EL-RI; No Copyright; Avail: CASI; [A02](#), Hardcopy

This is a brief report summarizing the equipment purchases and resulting research activities that have benefited from the

DoD equipment grant DAAG55-98-1-0329 entitled Instrumentation to Support Research in in Wireless Spread-Spectrum Communications. The various items purchased under this instrumentation grant and their costs are itemized under the list of purchased found at the end of this report.

DTIC

Spread Spectrum Transmission; Wireless Communication; Research And Development

20030067329

Development Platform for Streaming Multimedia Applications

Tikkala, A.; Mar. 2002; 70 pp.; In Finnish

Report No.(s): PB2003-105987; VTT/RN-2130; No Copyright; Avail: CASI; [A04](#), Hardcopy

The goal of this work was to develop a platform for streaming computer applications. The work included studying the properties of the most used multimedia platforms. They were analyzed to decide which ones must be included in the platform in order to achieve proper application functionality. The decision was easy to make because there are a number of de facto standards in this domain and those protocols must be supported in the name of compatibility. The possibility of using existing implementations was also examined.

NTIS

Compatibility; Protocol (Computers); Multimedia; Communication Networks

20030067359 Swedish Defence Research Establishment, Linköping

Design and Analysis of an All-optical Free-space Communication Link

Levander, F.; Sakari, P.; May 2002; In English

Report No.(s): PB2003-104342; FOI-R-0486-SE; No Copyright; Avail: National Technical Information Service (NTIS)

Free Space Optics (FSO) has received a great deal of attention lately both in the military and civilian information society due to its potentially high capacity, rapid deployment, portability and high security from deception and jamming. The main issue is that severe weather can have a detrimental impact on the performance, which may result in an inadequate availability. This report contains a feasibility study for an all-optical free-space link intended for short-range communication (200-500 m). Laboratory tests have been performed to evaluate the link design. Field tests were made to investigate availability and error performance under the influence of different weather conditions. Atmospheric impact due to turbulence related effects have been studied in detail. The most crucial part of the link design turned out to be the receiver optics and several design solutions were investigated. The main advantage of an all-optical design, compared to commercially available electro-optical FSO-systems, is the potentially lower cost.

NTIS

Optical Communication; Design Analysis; Electro-Optics; Communication Networks

20030067387 Army War Coll., Carlisle Barracks, PA

Trust - The Key to Leadership in Network Centric Environments

Kemp, Christopher R.; Apr. 7, 2003; 37 pp.; In English; Original contains color illustrations

Report No.(s): AD-A414603; No Copyright; Avail: CASI; [A03](#), Hardcopy

For the Army to function effectively in future Network Centric Warfare (NCW) environments, it must develop trust-based organizations by instilling trust-based competencies in leaders at all levels. This paper seeks to delineate the requirements necessary for the military to be truly effective in Network Centric environments. Much has been written regarding NCW and much has been written regarding leadership, but there has not been much research on linking the two together. There is, however, an extensive body of research discussing the current and past challenges the military has faced with developing trust-based organizations. This paper makes the argument that trustworthy leaders create trustworthy organizations that will result in more effective organizations in emergent environments. For these reasons, it is critical for future leaders, at all levels, to focus on leadership competencies beyond those identified in FM 22-100, 'Army Leadership.' (5 figures, 26 refs.)

DTIC

Leadership; Communication Networks; Human Relations

20030067400 Rutgers - The State Univ., Piscataway, NJ

Dataman Project-Information Services for Low-Powered Wireless Mobile Clients

Imielinski, Tomasz; Badrinath, B. R.; Mar. 2001; 7 pp.; In English

Contract(s)/Grant(s): DAAH04-95-1-0596

Report No.(s): AD-A413020; EIN/TIN-226001086; ARO-P-34971-EL; No Copyright; Avail: CASI; [A02](#), Hardcopy

The goal of the research effort in the DataMan Project is the development of novel wireless information services, location-dependent protocols such as geographic routing, and low energy protocols for wireless networks and devices. In each of the areas we have made progress and several results to report. First, the problem of efficient energy management and bandwidth utilization has been addressed using the concept of Meta-Channel designed for dissemination of information to wireless mobile users. Several protocols for low energy dissemination have been designed and demonstrated. Location dependent messaging has been made possible by the concept of Geographic Routing which has been designed and deployed to enable routing of messages to specific geographic areas for conveying location-dependent information. A complete user guide for geographic routing has been prepared. Finally, mechanisms for environment aware adaption in applications and protocols have been completed. Since, mobile users encounter widely varying network characteristics, there is a need for dynamic adaptation. To this end, we have designed a new family of environment-aware protocols.

DTIC

Protocol (Computers); Wireless Communication

20030067413 Swedish Defence Research Establishment, Linköping

Retrocommunication with Ferroelectric Liquid Crystal Modulators Preliminary Results

Oehgren, J.; Kullander, F.; Sjöqvist, L.; Dec. 2001; 32 pp.; In English

Report No.(s): PB2003-103246; FOI-R-0325-SE; No Copyright; Avail: CASI; [A03](#), Hardcopy

More developed communication abilities from land and air to submarine vessels and underwater systems, as well as communication entirely beneath the water surface, is believed to become important in the future. An interesting way to communicate is to use a laser, which is difficult to overhear (high directional), has a long range and the ability to transfer information with high speed. Unlike radio waves the blue-green laser wavelength can be transmitted several tenths of meters in the water. Other wavelengths can be used for the part of the communication from the air to the water surface, for example, IR above 1.5 micrometer, which is invisible and eye-safe. One concept is laser communication in a retrosystem: one operator has a laser transmitter/receiver (transceiver) while the other makes use of a retroreflector and modulator that encodes information. The operator makes benefits in reduced weight, volume and power consumption for this retromodulator. This report evaluates the use of retrocommunication in certain aspects. A free-space communication link is studied, which could be one part of a link from air into water. The link utilizes a laser with a 1.55 micrometer wavelength and a retromodulator consisting of a modulator and a retroreflector. The modulator is optical and based on liquid crystal technology. The reflector is realized using a cube corner prism.

NTIS

Underwater Vehicles; Communication Networks; Optical Communication

20030067415 Soar Technology, Inc., Ann Arbor, MI, USA

Cooperative Interface Agents for Networked Command, Control, and Communications (CIANC3)

Wood, Scott D.; Apr. 2003; 61 pp.; In English

Contract(s)/Grant(s): DASW01-02-C-0019; Proj-20262785A790

Report No.(s): AD-A414232; ARI-TR-1134; No Copyright; Avail: CASI; [A04](#), Hardcopy

The research reported here explored methods for effectively controlling FCS units containing mixed human and robotic elements. The objective was to determine whether an agent framework built around three specified agent types (Tasking, Coordinating, and Monitoring) could be constructed to add an intelligent abstraction layer between human commanders and battlefield elements. The focus was to identify human-system interaction issues, design potential solutions, and create software that supports the commander's tasks and mitigates inherent human performance limitations. A prototype interface agent architecture was designed, and a framework was implemented. Interface agents were created to perform in a simple, simulated battle scenario. The work conducted during Phase I lays the foundation for a Phase II plan to create more realistic scenarios and test the utility of interface agents in a variety of experimental settings.

DTIC

Command And Control; Human Performance; Prototypes

20030067433 Minnesota Univ., Minneapolis, MN, USA

Multi-Antenna Communications over Rapidly Fading Channels Estimation and Space-Time Coding

Giannakis, Georgios B.; Jan. 14, 2002; 6 pp.; In English

Contract(s)/Grant(s): DAAD19-00-1-0013

Report No.(s): AD-A414483; ARO-40935.1-CI; No Copyright; Avail: CASI; [A02](#), Hardcopy

This 3-year project dealt with development and testing of efficient algorithms for modeling and (blind) estimation of time-varying communication channels, and the resulting (self-recovering) antenna receivers and equalizers in rapidly fading mobile battlefield scenarios. Highlights of recent results include space-time coded transmit- and receive-diversity to combat noise, oscillator drifts, and Doppler effects; optimal wedding of beamforming with space-time coding; space-time-frequency coding for use over frequency-selective channels; space-time-Doppler coding for time-selective channels; and optimal training over doubly-selective channels.

DTIC

Coding; Channels (Data Transmission)

20030067526 California Univ., San Diego, CA, USA

BER and Error-Floor Calculation for Multi-Access PCTH

Maggio, Gian M.; Laney, David; Larson, Lawrence; Jan. 2002; 6 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0269

Report No.(s): AD-A414339; ARO-38560.107-MA-MUR; No Copyright; Avail: CASI; [A02](#), Hardcopy

Pseudo-chaotic time hopping (PCTH) is a recently proposed modulation scheme for UWB impulse radio. PCTH exploits concepts from symbolic dynamics to generate aperiodic spreading sequences. In this paper, we present a general analytical expression for the average BER (bit-error-rate) of synchronous multi-access PCTH system, as a function of the cross-correlation between the users' signatures in an AWGN (additive white Gaussian noise) channel. Also, it is shown that with enough users an error floor in the BER can develop.

DTIC

Random Noise; Bit Error Rate; Modulation; Multiple Access

20030067639 Army War Coll., Carlisle Barracks, PA

Joint C4I Interoperability-A Look at the Process for Army Transformation

Bethea, Robert L., Jr; Apr. 7, 2003; 38 pp.; In English

Report No.(s): AD-A414829; No Copyright; Avail: CASI; [A03](#), Hardcopy

Network Centric Warfare (NOW) is truly the embodiment of an information age transformation for the Department of Defense (DoD). It will involve new ways of thinking about how we accomplish our mission. It will also require new ways of operating that have not been conceived and employs technologies yet to be invented. Joint integration and joint interoperability will be absolutely required to effectively command and control the battle space of the future. The purpose of this strategic project report is to examine the DoD processes and policies that are in place to ensure joint compliancy for Army command, control, communications, computers and intelligence (C4I) equipment as we move towards DoD and Army transformation.

DTIC

Interoperability; Warfare; Communication Equipment; Control Equipment

20030067665 Newcastle-upon-Tyne Univ., Newcastle

Structuring Integrated Web Applications for Fault Tolerance

Romanovsky, A.; Periorellis, P.; Zorzo, A. F.; Feb. 2003; 30 pp.

Report No.(s): PB2003-105166; CS-TR-765; Copyright; Avail: National Technical Information Service (NTIS)

The intention of this paper is to demonstrate how modern structuring techniques can be employed in integrating complex web applications. The authors' focus is on developing a Travel Agency case study. The main challenges the developers of such systems face are dealing with legacy web services and incorporating means for tolerating a considerable number of errors. Because of the very nature of such systems, exception handling is the main recovery technique to be applied in their development. The authors employ Coordinated Atomic actions to allow disciplined handling of such abnormal situations by recursively structuring the integrated system and by associating handlers with such actions. To deal with legacy components, the authors used protective wrappers in such a way that each operation on these components is transformed into an atomic action with a well-defined interface. To accommodate a combined use of several ready-made environments (such as communication packages, services and run-time supports), the authors employ where necessary a multilevel exception handling. The design discussed in the paper shows the importance of choosing the right technique for structuring different parts of the integrated system. It is the authors' belief that the integration techniques discussed are generally applicable for

structuring integrated web applications of a wide range, as well as for providing their fault tolerance in a disciplined fashion.
NTIS
Fault Tolerance; Telecommunication

33

ELECTRONICS AND ELECTRICAL ENGINEERING

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment; and microelectronics and integrated circuitry. for related information see also *60 Computer Operations and Hardware*; and *76 Solid-State Physics*. For communications equipment and devices see *32 Communications and Radar*.

20030066241 Helsinki Univ. of Technology, Espoo, Finland

Design on High-Speed Electrical Machines. Postgraduate Seminar On Electromechanics

Lantto, E.; Arkkio, A.; January 2002; 96 pp.; In English

Report No.(s): PB2003-105143; Copyright; Avail: National Technical Information Service (NTIS)

No abstract available

NTIS

Electric Equipment; Electric Motors; Machinery

20030066271

Progress in Linear-Optics Quantum Computing

Franson, J. D.; Donegan, M. M.; Fitch, M. J.; Jacobs, B. C.; Pittman, T. B.; May 9, 2003; 4 pp.; In English

Contract(s)/Grant(s): DAAD19-02-1-0069

Report No.(s): AD-A413710; ARO-43389.7-PH-QC; No Copyright; Avail: CASI; [A01](#), Hardcopy

Quantum logic operations can be performed using linear optical elements ancilla photons, and corrections based on the results of measurements made on the ancilla. We have recently demonstrated several basic quantum logic operations using single photons, a technique for feed-forward control, a new source of single photon pseudo-demand, and a quantum memory device for single photons

DTIC

Quantum Computation; Linearity; Computer Storage Devices; Photons

20030066347 Delaware Univ., Newark, DE, USA

Optimization of Processing and Modeling Issues for Thin Film Solar Cell Devices

Birkmire, R. W.; Phillips, J. E.; Shafarman, W. N.; Eser, E.; Hegedus, S. S.; Jan. 2003; In English

Report No.(s): DE2003-15003223; No Copyright; Avail: National Technical Information Service (NTIS)

The overall mission of the Institute of Energy Conversion is the development of thin film photovoltaic cells, modules, and related manufacturing technology and the education of students and professionals in photovoltaic technology. The objectives of this 20 month NREL subcontract are to advance the state of the art and the acceptance of thin film PV modules in the areas of improved technology for thin film deposition, device fabrication, and material and device characterization and modeling, relating to solar cells based on CuInSe(sub2) and its alloys, on a-Si and its alloys, and on CdTe.

NTIS

Solar Cells; Cadmium Tellurides; Gallium Selenides; Indium Selenides; Copper Selenides

20030066921

Detection of Special Nuclear Material with High Purity Germanium (HPGe) and Mercuric Iodide (HgI2) Gamma Detectors

Nelson, Michael; Mar. 2003; 126 pp.; In English; Original contains color illustrations

Report No.(s): AD-A413884; AFIT/GNE/ENP/03-07; No Copyright; Avail: CASI; [A07](#), Hardcopy

The Defense Threat Reduction Agency (DTRA) contracted for two gamma radiation detectors: mercuric iodide (HgI2) and electromechanically cooled (EMC) high purity germanium (HPGe) to support arms control inspection efforts. This project investigated whether these detectors could measure the quality and quantity of special nuclear material (SNM), particularly Pu-239 for the treaty verification mission. The project investigated two areas of detector capabilities: 1) HgI2 and HPGe detector performance necessary to characterize the quality of plutonium and the presence of shielding materials and 2) HgI2 and EMC HPGe detector performance degradation by high noise levels and EMC HPGe detector performance degradation

caused by electromechanical-cooling. The first area studied the response functions of each of the detectors necessary to meet the detection objectives: measure the Pu-239/Pu 240 ratio to identify weapons grade plutonium and to identify a phony weapon. The second area of detector performance evaluated was the EMC HPGe detector's cooling capabilities and its effect on the performance of the detector. The results show that neither of the detectors was ideally capable of supporting DTRA's requirements. The HgI2 detector did not have sufficient efficiency or resolution to distinguish between Weapon Grade and Reactor Grade Plutonium. The EMC system suffered from grounding problems that degraded the resolution and efficiency. An initial study, evaluating the ability of detectors to determine the presence of a simulated tamper within the SNM physics package, showed great promise for identifying phony weapons.

DTIC

Analyzers; Mercury Compounds; Purity; Radiation Shielding; Absorbers (Materials)

20030066971 Florida International Univ., Miami, FL

Development of Micro Heat Pipes Embedded in Laminate Substrates for Enhanced Thermal Management (TM) for Printed Wiring Boards (PWBs)

Jones, K.; Cao, Y.; Gao, M.; Jun. 2002; 123 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F33615-99-1-2973; Proj-1660

Report No.(s): AD-A412953; AFRL-PR-WP-TR-2003-2011; No Copyright; Avail: CASI; [A06](#), Hardcopy

The objective of this work is the development of a process to fabricate an axial grooved heat pipe embedded in printed wiring board (PWB) technology and to evaluate its thermal, mechanical performance, and reliability. The results clearly show that the embedded heat pipe was operable and the heat transfer through the substrate was enhanced. However, the heat pipe was limited in the power input it could handle, as heat pipe failure occurred around 10 W by delamination of the PWB and subsequent loss of hermeticity and loss of the working fluid. After failure occurs, the heat pipe begins to behave as an uncharged heat pipe for the corresponding input the whole PWB starts increasing until it reaches the temperature distribution of the uncharged heat pipe for the corresponding input power. The development of a hermetic structure within the channel structure. Since the operation of the wick in the heat pipe is strongly dependent on the ability of the working fluid to wet the wick, the wetting angle of the plating material was measured for the various materials Option available (bare laminate, copper plating, other plating). The physical structure of the embedded heat pipes was analyzed by finite element analysis (FEA). The FEM results were compared with the experimental data to determine failure mode.

DTIC

Temperature Control; Heat Pipes

20030067207 New Mexico State Univ., Las Cruces, NM

Improving the Performance of Air Force Adaptive Optics Systems Using High-Resolution Spatial Light Modulators with Deformable Mirrors: Final Report

Giles, Michael K.; Vorontsov, Mikhail; Roggem, Michael; December 30, 2002; 43 pp.; In English

Contract(s)/Grant(s): F49620-99-1-0342

Report No.(s): AD-A413488; AFRL-SR-AR-TR-03-0155; No Copyright; Avail: CASI; [A03](#), Hardcopy

This document presents a comprehensive technical summary of the most significant work accomplished on Air Force Office of Scientific Research Contract Number F49620-99-1-0342. Since closed loop wave front control (WFC) systems currently being developed by the Air Force have residual wave front errors that reduce image quality, New Mexico State University has developed methods to reduce those residual errors and improve the quality (Strehl ratio) of Air Force WFC systems. Our approach is to develop concepts that utilize high-resolution spatial light modulators to improve the achievable system Strehl ratio. Two such concepts are (a) high resolution secondary WFC loops, and (b) reconfigurable Shack-Hartmann wave front sensors (RSHS) based on liquid crystal devices (LCD). A high-resolution adaptive optics test bed has been developed at NMSU using LCD's extracted from LCD projectors, and it has been used successfully to test both the secondary loop and RSHS concepts. Results indicate that both concepts improve system performance. wave front sensing, wave front control, adaptive optics

DTIC

Adaptive Optics; High Resolution; Light Modulators; Deformable Mirrors; Air Defense; Display Devices

20030067212 California Inst. of Tech., Pasadena, CA, USA

(BMDO) All-Optical Wavelength Coded Logic

Vahala, Kerry; Dec. 31, 2000; 11 pp.; In English

Contract(s)/Grant(s): F49620-97-1-0512; Proj-1651

Report No.(s): AD-A413534; AFRL-SR-AR-TR-03-0122; No Copyright; Avail: CASI; [A03](#), Hardcopy

F49620-97-1-0512 is the principal grant for all of this work; F49620-97-1-0430 was an ASSERT grant associated with F49620-97-1-0512 to furnish graduate-student support; and F49620-98-1-0409 was a DURIP award associated with the principal grant. This report describes the culmination and pinnacle of our effort on the logic-gate program stemming from the principal grant F49620-97-1-0512. This work began with the concept of all-optical spectral logic based on the polarization selection rules of four-wave mixing and culminated with multi-gate logic functions- a particular demonstration being an error detection/correction circuit as described herein.

DTIC

Logic Circuits; Data Transmission; Signal Processing; Coding

20030067214 California Univ., Santa Barbara, CA

Applied Nonlinear Control Design

Teel, Andrew R.; February 28, 2003; 16 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0106

Report No.(s): AD-A413514; AFRL-SR-AR-TR-03-0160; No Copyright; Avail: CASI; [A03](#), Hardcopy

New stability analysis tools and high performance control strategies were developed for nonlinear systems. Robust, high performance anti-windup algorithms were produced. New, comprehensive nonlinear stability analysis tools were discovered and used to motivate new control algorithms. A robust stability theory for discontinuous discrete-time systems was developed. New results on output feedback for nonlinear systems were described. A comprehensive multiple time scale stability theory for systems with disturbances was codified. A theory for extremum seeking in dynamical systems was developed and applied to industrial engine calibration problems.

DTIC

Nonlinear Systems; Control Systems Design; Control Theory; Aeronautical Engineering

20030067218 Rockwell Scientific Co., LLC, Thousand Oaks, CA, USA

Micromachined Radio Frequency (RF) Switches and Tunable Capacitors for Higher Performance Secure Communications Systems

DeNatale, Jeff F.; Apr. 2003; 65 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-97-C-0091; DARPA ORDER-E117; Proj-E117

Report No.(s): AD-A413515; AFRL-IF-RS-TR-2003-80; No Copyright; Avail: CASI; [A04](#), Hardcopy

The purpose of this program is to develop and demonstrate MEMS for RF communications applications. The development activities focus on two MEMS devices: RF Switches and Tunable Capacitors. The application of these components to RF subsystems offers the potential for substantial improvements in a number of performance metrics, including size, weight, power consumption, and parts count. The advantages of MEMS technology will be demonstrated in this program by insertions of these devices into three military communication subsystems, corresponding to the three following technical tasks: 1) MEM Tunable Capacitor-based UHF Tracking Filter for the F-22 Antenna Interface Unit (AIU), 2) MEM RF Switch-based VHF Tracking Filter for the Comanche Helicopter AIU, and 3) MEM tunable RF Filter (incorporating both MEM RF Switches and Tunable Capacitors) for the Receiver Pre-selector in the Joint Services ARC-210 Radio. Demonstration of MEMS RF switches in the space environment and the reliability assessment of RF Switches and Capacitors are also included.

DTIC

Radio Frequencies; Radio Communication; Microelectromechanical Systems; Micromachining

20030067219 California Univ., Los Angeles, CA, USA

Photocharge Transport and Recombination Measurements in Amorphous Silicon Films and Solar Cells by Photoconductive Frequency Mixing

Braunstein, R.; Boshta, M.; Sheng, S.; Kattwinkel, A.; Liebe, J.; Dec. 2002; In English

Report No.(s): DE2003-15003228; No Copyright; Avail: National Technical Information Service (NTIS)

No abstract available

NTIS

Amorphous Silicon; Frequencies; Photoconductivity; Silicon Films; Solar Cells

20030067222 Evans (Charles) and Associates, Sunnyvale, CA, USA

Electro-Optics Based on Novel Materials Modifications

Evans, Charles A., Jr.; Wilson, Robert G.; Sep. 12, 2001; 5 pp.; In English

Contract(s)/Grant(s): DAAD19-01-C-0042

Report No.(s): AD-A413617; ARO-42265.1-EL; No Copyright; Avail: CASI; [A01](#), Hardcopy

Aims or goals of this work included growth, doping and characterization of new materials of interest to ARO for electro-optics and electronics application within the DoD, often involving support for university research through collaborative programs initiated by Dr. John Zavada. A wide variety of materials were studied. The Group III-Nitrides were chosen as sources of multi-color LEDs and for high power/high temperature electronics. Rare earth elements were implanted into GaN to study their band edge luminescence and stimulated PL emission. Er, Pr and Eu implants into ZnO were also studied by these two optical techniques.

DTIC

Electro-Optics; Stimulated Emission; Optical Materials; High Temperature

20030067228 CALIFORNIA INST. OF TECH PASADENA OFFICE OF SPONSORED RESEARCH, Pasadena, CA, USA
(BMDO) All Optical Wavelength Coded Logic Gates

Vahala, Kerry; Nov. 30, 2000; 11 pp.; In English

Contract(s)/Grant(s): F49620-97-1-0430; Proj-3484

Report No.(s): AD-A413538; AFRL-SR-AR-TR-03-0120; No Copyright; Avail: CASI; [A03](#), Hardcopy

F49620-97-1-0512 is the principal grant for all of this work; F49620-97-1-0430 was an ASSERT grant associated with F49620-97-1-0512 to furnish graduate-student support; and F49620-98-1-0409 was a DURIP award associated with the principal grant This report describes the culmination and pinnacle of our effort on the logic-gate program stemming from the principal grant F49620-97-1-0512 This work began with the concept of all-optical spectral logic based on the polarization selection rules of four-wave mixing and culminated with multi-gate logic functions- a particular demonstration being an error detection!correction circuit as described herein.

DTIC

Logic Circuits; Optical Equipment; Optical Transition; Four-Wave Mixing

20030067256 Massachusetts Inst. of Tech., Cambridge, MA

Basic and Applied Research in Electronics and Optics

Kleppner, Daniel; Jun. 4, 2002; 14 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0080

Report No.(s): AD-A413676; ARO-P-37400.2-EL-JSE; No Copyright; Avail: CASI; [A03](#), Hardcopy

Research under this continuing grant is broadly devoted to discovering and characterizing new electronic and optical devices, and demonstrating their use for novel and critical applications. Theoretical and experimental progress on photonic bandgap structures holds promise for important advances in photonics. Progress in quantum circuit theory and self-assembly of nanoscale structures can-be expected to advance the frontiers of nanotechnology. Studies in ultrafast optics offer new ways to characterize the electronic response of materials.

DTIC

Electronics; Optics; Photonics

20030067268 Illinois Univ. at Urbana-Champaign, Urbana, IL

VCSEL and Smart Pixel Research for VLSI Photonics

Cheng, K. Y.; Dupuis, R. D.; Feng, M.; Forrest, S. R.; Holonyak, N., Jr; Feb. 25, 2003; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAG55-98-1-0303

Report No.(s): AD-A413699; DA-02-1; No Copyright; Avail: CASI; [A03](#), Hardcopy

The goal of this research program is to develop smart pixels and related technology for VLSI photonic systems. The native oxide and tunneling contact technology developed at the University of Illinois is the enabling technology for high performance vertical cavity surface emitting lasers (VCSELs) which will be used in future photonic systems and specifically in the smart pixels that are the focus of this research program. The smart pixel 8 x 8 (2.5 Gb/s) and 2 x 2 (20 Gb/s) arrays that will be studied will operate at 670 nm or 1330 nm and will utilize the native oxide defined VCSELs with tunnel junction contacts and heterogeneous materials integration through direct-wafer fusion, epitaxial lift-off, and bumpbonding techniques for integration and packaging. The University of Illinois and the University of Texas (20 GHz) and the Vitesse GaAs E/D MESFET/ MSM technology utilizing the MOSIS foundry (2.5 GHz).

DTIC

Surface Emitting Lasers; Pixels; Arrays; Tunnel Junctions

20030067280 Johns Hopkins Univ., Baltimore, MD
(BMDO) Materials Engineering Novel Semiconductor Structures

Khurgin, J. B.; Dec. 3, 1999; 16 pp.; In English

Contract(s)/Grant(s): F49620-98-1-0115; Proj-1651

Report No.(s): AD-A413773; AFRL-SR-AR-TR-03-0114; No Copyright; Avail: CASI; [A03](#), Hardcopy

Among the effects studied are interface island formation, photoluminescence saturation due to traps, localization and delocalization and associated with it superluminescence, cascading of nonlinear effects in vertical structures, optical rectification, and coherent current control. We propose to continue our research in the following directions: fabrication and testing of all-optical frequency shifters (and other cascading devices) for optical communications, further development of intersubband lasers, theoretical study of a fundamentally new type of low threshold 'image' lasers, investigation of all-semiconductor magnetic materials, and new types of electronic sensors.

DTIC

Semiconductors (Materials); Semiconductor Devices; Materials Science; Research; Engineering

20030067322 Army Research Lab., Adelphi, MD

Performance Bounds on Atmospheric Acoustic Sensor Arrays Operating in a Turbulent Medium II, Spherical-Wave Analysis

Collier, Sandra L.; Wilson, D. K.; Feb. 2003; 40 pp.; In English

Report No.(s): AD-A414468; ARL-TR-2904; No Copyright; Avail: CASI; [A03](#), Hardcopy

The performance bounds of a passive acoustic array operating in a turbulent medium with fluctuations described by a von Karman spectrum are investigated. This treatment considers a single, monochromatic, spherical-wave source and a line-of-sight propagation path. The Cramer-Rao lower bounds of the wave-front angles of arrival are calculated for an unknown parameter set which includes the propagation distance, turbulence parameters, source phase, and signal-to-noise ratio.

DTIC

Signal To Noise Ratios; Acoustics; Arrays; Detectors

20030067327 California Inst. of Tech., Pasadena, CA

Development and Application of Heterojunctions for Nanoelectronics for Silicon

McGill, T. C.; Nov. 2, 2002; 17 pp.; In English

Contract(s)/Grant(s): F49620-96-1-0021; Proj-D150

Report No.(s): AD-A414212; AFRL-SR-AR-TR-03-0170; No Copyright; Avail: CASI; [A03](#), Hardcopy

The goals of this program have been taken up by major efforts at IBM Watson Research Center, Intel Portland Technology Development Motorola and Texas Instruments. Our program has interacted with all of these programs except for the effort at Motorola. In particular the following areas have been addressed. First, the behavior of the semiconductor-insulator interface formed between silicon and cerium oxide has been quantified. Most important, the trap state density, interface roughness and conduction band offset with silicon are critical parameters in determining cerium oxide's usefulness for MOS applications. Secondly, more exact knowledge of the nature of cerium oxide in thin film form has been ascertained in order to predict its applicability as a tunnel barrier for a silicon heterostructure.

DTIC

Nanotechnology; Heterojunctions; Silicon; Metal Oxide Semiconductors; Dielectrics

20030067353 Lawrence Livermore National Lab., Livermore, CA, Kentucky Univ., Lexington, KY, USA

Numerical Technology for Large-Scale Computational Electromagnetics

Sharpe, R. M.; Champagne, N. J.; White, D. A.; Stowell, M.; Adams, R.; Jan. 30, 2003; In English

Report No.(s): DE2003-15003252; UCRL-ID-151789; No Copyright; Avail: National Technical Information Service (NTIS)

The key bottleneck of implicit computational electromagnetics tools for large complex geometries is the solution of the resulting linear system of equations. The goal of this effort was to research and develop critical numerical technology that alleviates this bottleneck for large-scale computational electromagnetics (CEM). The mathematical operators and numerical formulations used in this arena of CEM yield linear equations that are complex valued, unstructured, and indefinite. Also, simultaneously applying multiple mathematical modeling formulations to different portions of a complex problem (hybrid formulations) results in a mixed structure linear system, further increasing the computational difficulty. Typically, these hybrid linear systems are solved using a direct solution method, which was acceptable for Cray-class machines but does not scale

adequately for ASCI-class machines. Additionally, LLNLs previously existing linear solvers were not well suited for the linear systems that are created by hybrid implicit CEM codes. Hence, a new approach was required to make effective use of ASCI-class computing platforms and to enable the next generation design capabilities.

NTIS

Computational Electromagnetics; Mathematical Models; Numerical Analysis; Linearity

20030067362 Rensselaer Polytechnic Inst., Troy, NY

Plasma Wave Electronic Terahertz Technology

Shur, Michael S.; May 23, 2003; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-00-1-0073

Report No.(s): AD-A414495; ARO-41216.1-EL; No Copyright; Avail: CASI; [A03](#), Hardcopy

Plasma waves are oscillations of electron density in time and space. In deep submicron field effect transistors plasma wave frequencies lie in the terahertz range and can be tuned by applied gate bias. Since the plasma wave frequency is much larger than the inverse electron transit time in the device, it is easier to reach 'ballistic' regimes for plasma waves than for electrons moving with drift velocities. In the ballistic regime, no collisions of electrons with impurities or lattice vibrations occur on a time scale on the order of the plasma oscillation period, and the device channel acts as a resonant cavity for the plasma waves, making possible tunable resonant detection or even emission of the electromagnetic radiation in the terahertz range. In this report, we present the theory of plasma waves in field effect transistors; discuss instabilities of these waves in different device structures and their applications for detection and generation of the terahertz radiation.

DTIC

Field Effect Transistors; Plasma Waves

20030067394 Georgia Inst. of Tech., Atlanta, GA

Antennas for Use in Ground-Penetrating Radars Designed for Landmine Detection

Smith, Glenn S.; Jan. 7, 2002; 5 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0403

Report No.(s): AD-A414616; ARO-38882.8-EL-LMD; No Copyright; Avail: CASI; [A01](#), Hardcopy

The purpose of the research performed on this project was to investigate novel concepts for improving the performance of antennas for use in electromagnetic systems for detecting buried landmines. This research covered four areas: i) The completion of a theoretical and experimental study of the resistively-loaded vee antenna for use in short-pulse, ground-penetrating radars. ii) A fundamental study of the coupling between antennas that are very close to the surface of the earth and shallowly buried mines. This study makes use of a plane wave spectral analysis that contains both propagating and evanescent waves. iii) An investigation of the conical spiral antenna in free space and over the surface of the earth. This antenna has broadband and directive properties that make it particularly attractive for the mine detection problem. iv) A fundamental study of the transient radiation of electromagnetic energy from simple wire antennas.

DTIC

Antennas; Ground Penetrating Radar; Mines (Ordnance); Mine Detectors; Antenna Design

20030067399

Mechanical Diode Resonant Rectifying Actuator

Lesieutre, George A.; Koopmann, Gary H.; Mockensturm, Eric M.; Jan. 2003; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-00-1-0422; Proj-41346-EG

Report No.(s): AD-A414239; ARO-41346.1-EG; No Copyright; Avail: CASI; [A03](#), Hardcopy

The project goal is an efficient, conformable, high specific power actuator for use in agile high-speed DoD systems. Perm State pursued rotary motors based on the use of commercial roller clutches, while Virginia Tech demonstrated an efficient, regenerative drive system. The drive capacitors are roughly the same size as the motor piezos, thus bounding system size. Modeling indicated that the specific power of a bimorph-driven motor could be increased by a factor of 30 relative to initial SAMPSON technology; an 11X improvement was measured. The results indicated a limit of about 30 W/kg for such motors, inadequate to meet program goals, so stack-driven motors were subsequently pursued. Power output of 40 W and specific power of 30 W/kg were measured for the initial stack-driven motor. For such motors, Boeing and MPC suggested a focus on UCAVs, such as the XA5. This design was expected to provide a path to specific power in excess of 100 W/kg within a year. Achieving higher values will require diodes with smaller backlash; a number of devices were characterized as part of the

development of a scaling model, and several reversible diodes were developed. Base-driven resonant drive was explored, which could enable impedance matching to a load, while avoiding stack tensile stress limits. A nonlinear transmission that increases power transfer in linear-to-rotary motion by 40% was also demonstrated.

DTIC

Diodes; Actuators; Rectifiers

20030067418 Computer Sciences Corp., Moffett Field, CA, USA

Modeling of the Electro-Mechanical Response of Carbon Nanotubes: Molecular Dynamics and Transport Calculations

Svizhenko, Alexel; Anantram, M. P.; Maiti, Amitesh; May 05, 2003; 4 pp.; In English; International Workshop on Computational Electronics, 25-28 May 2003, Rome, Italy; Original contains black and white illustrations

Contract(s)/Grant(s): DTTS59-99-D-00437; NASA Order A-61812-D; Copyright; Avail: CASI; [A01](#), Hardcopy

This paper presents viewgraphs on the modeling of the electromechanical response of carbon nanotubes, utilizing molecular dynamics and transport calculations. The topics include: 1) Simulations of the experiment; 2) Effect of diameter, length and temperature; and 3) Study of sp³ coordination-‘The Table experiment’

CASI

Molecular Dynamics; Mathematical Models; Electromechanics; Carbon Nanotubes; Transport Theory

20030067459

Analysis of Switched Wire Antennas

Butler, Chalmers M.; Sep. 28, 2002; 4 pp.; In English

Contract(s)/Grant(s): DAAG19-00-1-0401

Report No.(s): AD-A414251; ARO-41070-EL; No Copyright; Avail: CASI; [A01](#), Hardcopy

The goals of this research project are to create the tools needed to analyze and understand loaded and switched antennas and to design the experimental apparatus needed to verify results obtained from computations. The antennas of interest cover the HF range and must be amenable to frequency hopping modulation schemes. Increase in bandwidth of monopole-like structures may be achieved by means of loading/tuning circuits and incremental bandwidth enhancement may be obtained by electronically switching antenna loads and elements. In this project, monopoles with shielded lumped loads are analyzed and results are confirmed experimentally. Also investigated are the coupling of time-domain signals between two closely spaced monopole antennas and the behavior of a time-domain signal injected at one port of a loaded loop antenna above a ground plane and sampled at the other port.

DTIC

Wire; Antenna Design; Antenna Components; Switching Circuits

20030067510

Theoretical Studies in Plasmas: Crossed-Field Devices and Ionospheric Plasmas

Kaup, D. J.; Dec. 31, 2002; 7 pp.; In English

Contract(s)/Grant(s): F49620-00-C-0001

Report No.(s): AD-A414265; AFRL-SR-AR-TR-03-0178; No Copyright; Avail: CASI; [A02](#), Hardcopy

Crossed-field devices: The Item A.(i) has been done and a manuscript was published in the Journal of Plasma Physics. This is a summary of the current understanding of the physics behind the operation of the non-relativistic devices. On Item A.(ii), a manuscript was published in the proceedings of the SPIE Orlando meeting in April, 2001. This treatment was for a planar device, operating in the same general parameter regime as the A6 magnetron. Work has been, completed on the relativistic cylindrical model of the A6 magnetron. A manuscript is being prepared to detail these results. On Item A, (iii), in an unpublished effort, we have also reviewed further the effect that the relativistic corrections would have on the non-relativistic T266 of CPI. We found that these corrections are rather small, as one would expect. A result from the relativistic electromagnetic model is that, strictly speaking, a two-dimension model of a crossed field device is not valid, unless such a device is either infinitesimally thin or operating in a stationary mode. How thin is ‘thin’ for computational purposes, has not been determined. Further comments will be made below. Work has continued on the saturated operating stage. A relativistic cylindrical version, has been obtained with the aid of MACSYMA. However, the expressions are sufficiently complex that it was determined that we should first, study the simpler non-relativistic planar model of the T266, as an initial numerical study of this stage of operation. What we have observed is that our model of the relativistic cylindrical AG magnetron indicates the A6 to be potentially more unstable in the saturated operating stage, than the T266 was. This instability

would show up as a breakdown in the coherent transfer of electrons from the cathode to the anode.

DTIC

Ionospheres; Crossed Fields; Computer Programs

20030067636 National Defence Research Establishment, Linköping, Sweden

Uncooled IR sensors: Market Overview and Applications

Svensson, T.; Jan. 2002; In Swedish

Report No.(s): PB2003-104350; FOI-R-0391-SE; No Copyright; Avail: National Technical Information Service (NTIS)

This report contains an overview of manufacturers of uncooled IR systems and their performance characteristics, as well as a pilot study of possible applications. Uncooled IR systems have some certain advantages over cooled IR systems: high reliability, low weight, low power requirement, low price. A low price leads to a bigger number of potential buyers and more applications. This in turn leads to a fast sale leading to lower prices. The actors on the market are mainly American companies. Recently, however, several countries in Europe and Asia have developed their own uncooled IR systems. In applications for uncooled IR systems advantage is taken of the small size and the low power requirement. Examples are surveillance, weapon sights and night vision in cars. Uncooled IR systems are well adapted to small mobile systems, which are expected to play a key role in future military operations. Small mobile units can be used for surveillance of e.g. border sectors and may consist of separate IR sensors or combinations with other types of sensors, so-called multi sensors. In future applications uncooled IR sensors may be utilized as parts of sensor networks where radio transmitters are used for wireless communication between the sensors.

NTIS

Infrared Detectors; Sensors; General Overviews; Manufacturing

20030067641 Delaware Univ., Newark, DE

Mesoscopic Diffractive Optics for Electronic Warfare applications

Prather, Dennis; May 2002; 10 pp.; In English

Contract(s)/Grant(s): N00014-99-1-0519

Report No.(s): AD-A414831; No Copyright; Avail: CASI; [A02](#), Hardcopy

In this report we present our progress in the integration of an 850-nm VCSEL, its driven and a mesoscopic diffractive lenslet array onto a single substrate to produce an integrated opto-electronic multi-chip module for signal fan-out and distribution. The diffractive element performs optical fan-out of the output beam from the VCSEL into an array of focused spots at a plane 1416 μm from the surface of the VCSEL. This corresponds to 160 μm from the surface of the diffractive lens. System design, fabrication, integration, and experimental characterization are presented.

DTIC

Warfare; Chips; Diffractive Optics

34

FLUID MECHANICS AND THERMODYNAMICS

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also *02 Aerodynamics*.

20030066237 ATK-Thiokol Propulsion, Brigham City, UT, USA

Development of Erosive Burning Models for CFD Predictions of Solid Rocket Motor Internal Environments

Wang, Qun-Zhen; [2003]; 12 pp.; In English; 39th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 20-23 Jul. 2003, Huntsville, AL, USA

Contract(s)/Grant(s): NAS8-97238

Report No.(s): AIAA Paper 2003-4809; Copyright; Avail: CASI; [A03](#), Hardcopy

Four erosive burning models, equations (11) to (14), are developed in this work by using a power law relationship to correlate (1) the erosive burning ratio and the local velocity gradient at propellant surfaces; (2) the erosive burning ratio and the velocity gradient divided by centerline velocity; (3) the erosive burning difference and the local velocity gradient at propellant surfaces; and (4) the erosive burning difference and the velocity gradient divided by centerline velocity. These models depend on the local velocity gradient at the propellant surface (or the velocity gradient divided by centerline velocity) only and, unlike other empirical models, are independent of the motor size. It was argued that, since the erosive burning is a local phenomenon occurring near the surface of the solid propellant, the erosive burning ratio should be independent of the

bore diameter if it is correlated with some local flow parameters such as the velocity gradient at the propellant surface. This seems to be true considering the good results obtained by applying these models, which are developed from the small size 5 inch CP tandem motor testing, to CFD simulations of much bigger motors.

Derived from text

Computational Fluid Dynamics; Solid Propellant Rocket Engines; Velocity Distribution; Erosive Burning; Flow Characteristics

20030066277 NASA Marshall Space Flight Center, Huntsville, AL, USA

Performance of WPA Conductivity Sensor during Two-Phase Fluid Flow in Microgravity

Carter, Layne; O'Connor, Edward W.; Snowden, Doug; 2003; 11 pp.; In English; 33rd International Conference on Environmental Conference on Environmental Systems, 7-10 Jul. 2003, Vancouver, BC, USA; Copyright; Avail: CASI; [A03](#), Hardcopy

The Conductivity Sensor designed for use in the Node 3 Water Processor Assembly (WPA) was based on the existing Space Shuttle application for the fuel cell water system. However, engineering analysis has determined that this sensor design is potentially sensitive to two-phase fluid flow (gas-liquid) in microgravity. The source for this sensitivity is the fact that gas bubbles will become lodged between the sensor probe and the wall of the housing without the aid of buoyancy in 1-g. Once gas becomes lodged in the housing, the measured conductivity will be offset based on the volume of occluded gas. A development conductivity sensor was flown on the NASA Microgravity Plan to measure the offset, which was determined to range between 0 and 50%. Based on these findings, a development program was initiated at the sensor's manufacturer to develop a sensor design fully compatible with two-phase fluid flow in microgravity.

Author

Two Phase Flow; Fluid Flow; Microgravity; Bubbles

20030066368 Moscow Univ., Moscow, Russia

Gas Jets

Chaplygin, S.; Scientific Memoirs; August 1944, pp. 1-121; In English

Report No.(s): NACA-TM-1063; No Copyright; Avail: CASI; [A06](#), Hardcopy

A brief summary of the contents of this paper is presented here. In part I the differential equations of the problem of a gas flow in two dimensions is derived and the particular integrals by which the problem on jets is solved are given. Use is made of the same independent variables as Molenbroek used, but it is found to be more suitable to consider other functions. The stream function and velocity potential corresponding to the problem are given in the form of series. The investigation on the convergence of these series in connection with certain properties of the functions entering them forms the subject of part II. In part III the problem of the outflow of a gas from an infinite vessel with plane walls is solved. In part IV the impact of a gas jet on a plate is considered and the limiting case where the jet expands to infinity changing into a gas flow is taken up in more detail. This also solved the equivalent problem of the resistance of a gaseous medium to the motion of a plate. Finally, in part V, an approximate method is presented that permits a simpler solution of the problem of jet flows in the case where the velocities of the gas (velocities of the particles in the gas) are not very large.

Derived from text

Gas Jets; Gas Flow; Two Dimensional Flow; Flow Equations; Convergence

20030066884 NASA Marshall Space Flight Center, Huntsville, AL, USA

Performance Theory of Diagonal Conducting Wall MHD Accelerators

Litchford, R. J.; [2003]; 15 pp.; In English; 34th AIAA Plasmadynamics and Lasers Conference, 23-26 Jun. 2003, Orlando, FL, USA; Original contains black and white illustrations

Report No.(s): AIAA Paper 2003-4284; No Copyright; Avail: CASI; [A03](#), Hardcopy

The theoretical performance of diagonal conducting wall crossed field accelerators is examined on the basis of an infinite segmentation assumption using a cross-plane averaged generalized Ohm's law for a partially ionized gas, including ion slip. The desired accelerator performance relationships are derived from the cross-plane averaged Ohm's law by imposing appropriate configuration and loading constraints. A current dependent effective voltage drop model is also incorporated to account for cold-wall boundary layer effects including gasdynamic variations, discharge constriction, and electrode falls. Definition of dimensionless electric fields and current densities lead to the construction of graphical performance diagrams,

which further illuminate the rudimentary behavior of crossed field accelerator operation.

Author

Magnetohydrodynamics; Accelerators; Performance; Electrical Resistivity; Gas Dynamics

20030067083 Fraunhofer-Inst. fuer Kurzzeitdynamik, Freiburg im Breisgau, Germany

Techniques of Shock Wave Experiments and Determination of Hugoniot Data of Solids

Thoma, K.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

In this paper the current techniques used in laboratory shock wave compression of heterogeneous solids will be reviewed with special emphasis on materials used in industrial applications, and on own work at the EMI. These techniques can be fully applied also to geological materials (minerals and rocks).

Derived from text

Shock Waves; Rocks; Experimentation

20030067196 Naval Undersea Warfare Center, Newport, RI

High Efficiency Low Actuation Force Inlet Door

Gieseke, Thomal J., Inventor; Nov. 12, 2002; 18 pp.; In English

Patent Info.: Filed 11 Dec. 2002; US-Patent-Appl-SN-10292954

Report No.(s): AD-D020068; No Copyright; Avail: Other Sources; , Microfiche

An inlet system for an inlet in a flow field includes an inlet recess housing having an interior with forward and rear end walls, a base wall, and an opening formed in an upper surface thereof. An intake duct is formed in a rear end wall of the inlet recess. An inlet door has a first end pivotally connected to a forward wall and a trailing edge directed to the rear end wall of the inlet housing such that the inlet door selectively closes the opening of the inlet housing. An overlap member can extend from the rear end wall of the inlet recess to a predetermined distance adjacent a trailing edge of the door.

DTIC

Flow Distribution; Inlet Flow; Actuation; Intake Systems

20030067232 Texas Univ., Austin, TX

Experimental Study of the Structure of Shock-Induced Turbulent Separated Flow and its Role in Flowfield Unsteadiness

Dolling, David S.; Clemens, Noel T.; Dec. 2, 2002; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAG55-98-1-0290

Report No.(s): AD-A413564; ARO-37798-EG; No Copyright; Avail: CASI; [A03](#), Hardcopy

This project was aimed at understanding the fundamental cause of the low frequency unsteadiness present in shock-induced turbulent separated flows. A particular emphasis was placed on investigating the role that the upstream boundary layer plays in driving the motion of the separated flow. Three different interactive flows were studied, which included interactions generated by Mach 2 and 5 unswept compression ramps a Mach 5 blunt fin. This study emphasized the use of imaging techniques - such as planar laser scattering and particle image velocimetry (PIV) -- to monitor the conditions in the upstream turbulent boundary layer. For the first time in a shock-induced separated flow, a new multi-camera, multi-laser PIV system was used that enabled both wide-field PIV and time sequenced PIV measurements to be made. Velocity fluctuations in the lower part of the upstream boundary layer were found to be strongly correlated with shock foot motion. This same correlation was demonstrated in both compression ramp and blunt fin interactions. In corroboration of this mechanism, pulsed jet injection was used in the upstream boundary layer to show that the shock can be made to respond to changes in the velocity field induced by the pulsed jets.

DTIC

Turbulent Boundary Layer; Particle Image Velocimetry; Boundary Layer Separation; Separated Flow; Shock Wave Attenuation

20030067242 Minnesota Univ., Minneapolis, MN

Studies of Aerodynamic Breakup, Cavitation and Rupture of Fluids

Joseph, Daniel D.; Dec. 31, 2001; 4 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-3014

Report No.(s): AD-A413634; ARO-38361.3-MA; No Copyright; Avail: CASI; [A01](#), Hardcopy

The problem of breakup of masses of liquid agents moving at supersonic speeds at high altitudes is important for missile defense and other Army problems. Traditionally such studies are carried out in expensive field, sled and reverse ballistic tests. To reduce costs and improve controllability, we have built a shock tube with Mach 8 capability to study breakup; it works well and we are taking some data: see http://www.aem.umn.edu/research/Aerodynamic_Breakup. This proposal is to do systematic comparisons of breakup on a wide range of simulants using our shock tube and to do theoretical studies to interpret the data. Another goal is to embed breakup studies in as yet underdeveloped branch of mechanics which I call the 'breaking strength of materials'. The theory of cavitation, the tensile strength of liquids and the fracture of amorphous solids may be framed in a unified manner in which the breaking strength is compared to stresses along the principle axes of stress. The formation of cracks or bubbles is probably controlled by the mobility of the material which can be different even in the same material, say, in molten and frozen glass. We seek to make a connection between the aerodynamic breakup of liquids and topics related to cavitation, condensation, diffusion and outgassing of dissolved gas.

DTIC

Cavitation Flow; Fluids; Liquids; Aerodynamics; Rupturing

20030067304 Texas Univ., Austin, TX

Experimental Investigation of Upstream Boundary Layer Acceleration on Unsteadiness of Shock-Induced Separation

Dolling, David S.; Clemens, Noel T.; Apr. 26, 2003; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-02-1-0294

Report No.(s): AD-A414559; ARO-44073-EG-II; No Copyright; Avail: CASI; [A03](#), Hardcopy

This project was aimed at understanding the fundamental cause of the low frequency unsteadiness present in shock-induced turbulent separated flows. A new multi-camera, multi-laser PIV system was used to capture wide-field images of the velocity field in a Mach 2 compression ramp interaction. The PIV was acquired simultaneously with fast-response pressure measurements to identify the shock-foot location at the same time that the PIV data were captured. The measurements showed that the global structure of the interaction was substantially different depending on the location of the separation shock foot. For example, when the shock is upstream, the scale of the separated flow, the velocity fluctuations and the domain of perturbed flow, are all substantially larger than when the shock-foot is located downstream. Most importantly, a clear correlation was observed between the thickness and velocity profile in the upstream boundary layer and the shock foot position. A new technique for measuring the upstream boundary layer acceleration by using two-frame time-sequenced PIV was also developed. This involved developing new hardware and software tools, and conducting preliminary calibration experiments. This work has shown the feasibility of correlating the upstream acceleration to the shock motion and these measurements will be made in future work.

DTIC

Shock Waves; Turbulent Boundary Layer; Supersonic Flow; Boundary Layer Separation

20030067311 Institut Franco-Allemand de Recherches, Saint-Louis

Enhanced Doppler Picture Velocimetry (DPV) for Planar Velocity Measurements in High Speed Shock Tunnel Flow

Seiler, F.; George, A.; Leopold, F.; Havermann, M.; Srujijes, J.; Jan. 2002; 16 pp.; In English

Report No.(s): AD-A414485; ISL-PU-621/2002; No Copyright; Avail: CASI; [A03](#), Hardcopy

A technique for visualizing a velocity field in an entire plane has been developed by taking so-called 'Doppler Pictures' using Michelson interferometry. With the Doppler Picture Velocimetry (DPV) information about the instantaneous and local velocities of tracers passing through a light sheet are available. The tracer particles are illuminated by a laser light source and the frequency of the scattered light, in case of moving particles, is shifted by the Doppler effect. This small Doppler shift of the frequency of the light scattered by tracer particles is transformed by a Michelson interferometer into varying light intensities as interferometer output. Therefore, the light intensity distribution on the Doppler picture gives information on the Doppler frequency shift and in consequence on the speed of the tracer particles crossing the light sheet plane. The technique for taking and processing the Doppler picture images was enhanced in the last years and the status of progress of the DPV method will be described first with the tests using a rotating disc and a free jet for DPV technique calibration, and secondly with an application in high speed fluid mechanics showing the velocity distribution in a light sheet plane crossing a supersonic wedge flow generated in ISL's high energy shock tunnel STB. The Doppler picture, taken with the enhanced set-up by a CCD camera, is pixel-wise computer-processed for velocity presentation using an image processing software which is specially developed at ISL for DPV purposes.

DTIC

Flow Visualization; Shock Tunnels; Doppler Effect; Velocity Measurement

20030067313 Pennsylvania State Univ., University Park, PA

Computational Hydrodynamics and Control Modeling for Autonomous Underwater Vehicles

Bradley, David L.; Jan. 15, 2003; 5 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-98-1-0869

Report No.(s): AD-A414572; No Copyright; Avail: CASI; [A01](#), Hardcopy

The long term objective of the program is to develop predictive technologies to support virtual design and evaluation of underwater vehicles systems. CFD technologies will be used to protect hydrodynamic models for AUVs and those models will be coupled with control system design and modeling tools to allow vehicle conceptual design to be evaluated within the context of a realistic mission. The objectives of this effort were to compare the forces and moments acting on a maneuvering AUV predicted by computational fluid dynamics (CFD) code with similar data collected aboard an operational AUV. In particular, the multi-block Navier-Stokes flow solver UNCLE (Unsteady Computational of Field Equations) was used in this effort.

DTIC

Computational Fluid Dynamics; Control Surfaces; Hydrodynamics; Control Systems Design

20030067340 Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese

LES Investigation of Coherent Structures in Boundary Layers and Wakes. Volume IV: Summary of Work Accomplished and Final Conclusions

Benocci, Carlo; Degrez, Gerard; Dec. 2002; 19 pp.; In English

Contract(s)/Grant(s): N00014-99-1-0834

Report No.(s): AD-A414446; No Copyright; Avail: CASI; [A03](#), Hardcopy

Present text summarizes the work performed during the present investigation to assess the feasibility to simulate and study coherent structures in turbulent shear layers making use of Large Eddy Simulations (LES), and whose results are detailed in the three companion volumes R. Giammanco and C. Benocci (2003a), R. Giammanco and C Benocci (2003b) and G. Degrez and D. Snyder (2003), which complete the present report.

DTIC

20030067360 Fluor Daniel Hanford, Inc., Richland, WA, USA

Krohne Flow Indicator and High Flow Alarm Local Indicator and High Flow Alarm of Helium Flow from the SCHe Purge Lines C and D to the Process Vent. Revision 2

Miska, C.; Sep. 03, 2000; 22 pp.; In English

Report No.(s): DE2003-804842; SNF-3922-REV-2; No Copyright; Avail: Department of Energy Information Bridge

Flow Indicators/alarms FI/FSH-5*52 and -5*72 are located in the process vent lines connected to the 2 psig SCHe purge lines C and D. They monitor the flow from the 2 psig SCHe purge going to the process vent. The switch/alarm is non-safety class GS.

NTIS

Helium; Warning Systems; Spent Fuels; Vents

20030067412 NASA Marshall Space Flight Center, Huntsville, AL, USA

Comparison of Experimental Data and Computations Fluid Dynamics Analysis for a Three Dimensional Linear Plug Nozzle

Ruf, J. H.; Hagemann, G.; Immich, H.; [2003]; 3 pp.; In English; 39th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, July 2003, Huntsville, AL, USA; Original contains black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

A three dimensional linear plug nozzle of area ratio 12.79 was designed by Astrium. The nozzle was tested within the German National Technology Program LION in a cold air wind tunnel by TU Dresden. The experimental hardware and test conditions are described. Experimental data was obtained for the nozzle without plug side wall fences and then with plug side wall fences. Experimental data for two nozzle pressure ratios (NPR), 116 and 45, are presented for the without fence and with fence configurations. Schlieren images of both NPR were recorded. Axial profiles of plug wall static pressures were measured at several spanwise locations and on the plug base. Detailed computational fluid dynamics (CFD) analysis was performed for these nozzle configurations by NASA MSFC. The CFD exhibits good agreement with the experimental data. A detailed comparison of the CFD results and the experimental plug wall pressure data is given for four test conditions; at both NPRs, without and with plug side wall fences. Numerical schlieren images are compared to experimental schlieren images. Nozzle

thrust efficiencies are calculated from the CFD results. The CFD results are used to illustrate the plug nozzle fluid dynamics for all four test conditions. The effect of the plug side wall fences at both NPRs is emphasized.

Author

Computational Fluid Dynamics; Plug Nozzles; Wind Tunnels; Three Dimensional Flow; Linearity

20030067440 Air Force Inst. of Tech., Wright-Patterson AFB, OH

A Digital Particle Image Velocimetry Investigation of Delta Wing Vortex Flow and Vortex Breakdown

Wimer, Jeremy D.; Jan. 2003; 128 pp.; In English; Original contains color illustrations

Report No.(s): AD-A414308; AFIT-CI-02-963; No Copyright; Avail: CASI; [A07](#), Hardcopy

The vortical flow over the suction side of a 650 sweep delta wing at high angles of attack is investigated in the University of Washington water tunnel using digital particle image velocimetry (DPIV). The method is first validated and then used to qualitatively and quantitatively describe the development of the leading edge vortex (LEV) both upstream and downstream of vortex breakdown. The circulation and azimuthal velocity profile in the vortex are measured and reveal that the maximum circulation of the LEV increases nearly linearly in the downstream direction up to the point of vortex breakdown. Circulation and velocity measurements in the solid-body rotational part of the LEV core, however, reveal that once the core is formed near the apex of the wing, the circulation there remains constant until just prior to breakdown, and no further vorticity is added to the core from the shear layer. The secondary vortex is found to be the key player in separating the primary vortex core from the shear layer. This model of the flow field contradicts the generally accepted conical nature of delta wing flow. Current vortex breakdown suppression methods are analyzed in light of this new model. A numerical simulation based on the vortex filament method is also used to further the self-induction theory of vortex breakdown.

DTIC

Delta Wings; Particle Image Velocimetry; Vortex Breakdown; Vortex Filaments; Water Tunnel Tests; Flow Distribution

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INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography. For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Avionics and Aircraft Instrumentation*; and *19 Spacecraft Instrumentation and Astrionics*.

20030066248

Contacts to AlGa_N for UV Detectors

Mohney, Suzanne E.; Mar. 31, 2003; 30 pp.; In English

Contract(s)/Grant(s): F49620-99-1-0176

Report No.(s): AD-A413801; AFRL-SR-AR-TR-03-0124; No Copyright; Avail: CASI; [A03](#), Hardcopy

Electrical contacts to AlGa_N were investigated at The Pennsylvania State University.

DTIC

Ultraviolet Detectors; Electric Contacts; Aluminum Nitrides; Gallium Nitrides

20030066281 Delaware Univ., Newark, DE

SiGe Intersubband Detectors for Terahertz Communication and Sensing

Kolodzey, James; Feb. 2003; 14 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0042

Report No.(s): AD-A413737; 03-3-21-3130-42; AFRL-SR-AR-TR-03-0110; No Copyright; Avail: CASI; [A03](#), Hardcopy

We report on the design and fabrication of THz detectors based on silicon germanium nanostructures grown by MBE to obtain intersubband transitions in the energy range from 4.1 meV to 4.1 meV (1 to 10 THz). The absorption and photoresponse was characterized by Fourier Transform Infrared Spectroscopy (FTIR), and simulated using a 6 band k*p band structure calculation. A multistep SiGe quantum well structure was designed and fabricated to have transitions between two heavy hole (HH) states. The best device, SGC 439, had an absorption spectrum that agreed reasonably with the photocurrent spectrum and showed response peaks at 280 and 360/cm (8.4 THz and 10.8 THz) with the sample temperature at 77 K. It is concluded that SiGe quantum well devices are feasible as THz detectors.

DTIC

Detectors; Silicon Compounds; Germanium Compounds

20030066324

C (G)-Band & X (I) - Band Noncoherent Radar Transponder Performance Specification Standard

Apr. 2002; 153 pp.; In English; Original contains color illustrations

Report No.(s): AD-A412962; RCC-STANDARD-262-02; No Copyright; Avail: CASI; [A08](#), Hardcopy

This document sets forth the minimum transponder parameter requirements for both C (G)-band and X (I)-band, noncoherent, pulse-type transponder sets that any instrumentation tracking radar on any test range may use. The transponder set consists of a receiver and a transmitter with integral power supply. The function of this transponder set is to extend tracking range, increase precision, improve target tracking identification, and to extend the low-level tracking capability of precision tracking C (G)-band instrumentation radar sets such as the AN/FPS-16, AN/MPS-36, and X (I)-band radar sets such as the NIKE hercules, and others.

DTIC

Radar Receivers; Radar Transmitters; Transponders; Functional Design Specifications; Microwave Frequencies

20030066540 Aarhus Univ., Denmark

Testing of Magnets for the Mars Exploration Rover Missions

Jensen, J.; Bertelsen, P.; Folkmann, F.; Kinch, K.; Goetz, W.; Gunnlaugsson, H. P.; Jakobsen, R.; Knudsen, J. M.; Madsen, M. B.; Merrison, J. P., et al.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Viking landers and the Pathfinder lander carried instrument packages to investigate the magnetic properties of the soil and dust on Mars. The instruments consisted of small permanent magnets that attracted and accumulated magnetic dust particles from suspension in the Martian atmosphere. From the results we know that there is a strong magnetic component in the Martian soil and dust.

Derived from text

Instrument Packages; Magnets; Mars Atmosphere

20030066575 Hong Kong Polytechnic, Kowloon, Hong Kong

First Planetary Rock Coring in Our Solar System...ESA 2003 Beagle 2 Mars Lander

Ng, T. C.; Yung, K. L.; Yu, C. H.; Chan, C. C.; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy

ESA is going to send Beagle 2 to Mars in 2003 for exobiology exploration. On board, there are 3 sampling tools on board as follows: 1/ ROCK CORER - able to retrieve powdered rock sample; 370 gm in mass; size of a cigarette pack; 2 watts energy consumption; able to drill/grip/core/grind; multi-operational; split drill-bits design for antijamming. 2/SCOOP - gripper able to open/close by pressure; able to retrieve surface soil sample; device designed in case the rock corer is not functioning; multioperational. 3/ MOLE - able to retrieve subsurface soil at required depth; multi-operational. All the sampling tools are able to deliver samples into GCMS for in-situ analysis.

Derived from text

Spacecraft Instruments; Mars Roving Vehicles

20030066605 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

The SEIS Experiment: A Mars Seismic Package

Schibler, P.; Lognonne, P.; Giardini, D.; Banerdt, B.; Karczewski, J. F.; Mimoun, D.; Zweifel, P.; Pike, T.; Ammann, J.; Anglade, A., et al.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

This experiment will integrate a VBB (Very Broad Band) two axis seismometer, a three axis Short Period seismometer and a series of environmental sensors for pressure, infra-sounds and temperature. IGP (France) has the overall responsibility of the experiment and is responsible for the VBB and environmental sensors. ETHZ (Switzerland) is responsible for the electronics of the experiment and JPL (USA) for the SP (Short Period) sensors. SEIS instrument was first proposed and accepted for NetLander mission (and will also be in charge of data acquisition for SPICE experiment). This seismic package should also be proposed for future missions.

Derived from text

Seismographs; Data Acquisition

20030066641 Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau, Germany

The Microscope for the Beagle 2 Lander on ESA's Mars Express

Keller, H. U.; Markiewicz, W. J.; Bluemchen, T.; Basilevsky, A. T.; Smith, P. H.; Tanner, R.; Oquest, C.; Reynolds, R.; Josset, J.-L.; Beauvivre, S., et al.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The European Space Agency (ESA) will launch the Mars Express spacecraft in June 2003. The mission is intended to provide a flight opportunity for re-builds of experiments lost as a result of the Russian Mars '96 launch failure and will reach Mars around Christmas 2003. The re-build has allowed several instruments to be improved and upgraded. However, a completely novel element of the Mars Express payload is the Beagle 2 lander. Beagle 2 is designed to descend through the atmosphere of Mars to the surface using a combination of aerobraking, parachutes, and airbags.

Derived from text

Spacecraft Instruments; Mars Probes; Mars Surface Samples; Microscopes; Design Analysis

20030066708 La Sapienza Univ., Rome, Italy

The MRO Subsurface Sounding Shallow Radar (SHARAD)

Seu, R.; Orosei, R.; Biccari, D.; Masdea, A.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

SHARAD (SHallow RADar) is a subsurface sounding radar provided by ASI as a Facility Instrument to NASA's 2005 Mars Reconnaissance Orbiter (MRO) mission for the characterisation of the uppermost part of the Martian interior. MRO will be launched on August 2005 from Cape Canaveral Air Force Station and will deliver a payload designed to provide observations from a low Mars orbit, with a nominal science period starting from September 2005. SHARAD operating parameters, a 20 MHz central frequency with a 10 MHz bandwidth, will allow to study the planet in a way that will be complementary to the Italian-US sounding radar MARSIS (Mars Advanced Radar for Subsurface and Ionosphere Sounding) in terms of scale and resolution.

Derived from text

Mars Atmosphere; Planetary Ionospheres

20030066737 Cornell Univ., Ithaca, NY, USA

Mars Acoustic Anemometer: Eddy Fluxes

Banfield, D.; Dissly, R.; Toigo, A. D.; Gierasch, P. J.; Dagle, W. R.; Schindel, D.; Hutchins, D. A.; Khuri-Yakub, B. T.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

We are developing an acoustic anemometer for use in the low pressure atmosphere of Mars. Acoustic anemometers have high sensitivity, high temporal resolution, high accuracy, are insensitive to radiative heating and demand little power. In these ways they are superior to the anemometers previously flown to Mars. Accurate, well calibrated anemometers are crucial for understanding the near surface atmospheric environment (e.g., slope winds, convective cells, dust devils, and aeolian processes in general). Furthermore, the high time resolution, sensitivity, 3 D capabilities and well defined, open sampling volume available from an acoustic anemometer allow it to resolve individual turbulent eddies, a first for Mars. This feature allows it to directly measure eddy fluxes, for example water vapor vertical fluxes between the surface and atmosphere when coupled with a fast hygrometer (e.g. a TDL). This novel ability to measure water vapor fluxes is viewed as a high priority science goal of Mars landers. We expect that the instrument designed in this program will be a prime candidate to fly on either the Mars Science Laboratory Lander, or any of the future planned Mars Scout landers or Mars Surveyor Landers. Acoustic anemometers are well developed for Earth, but need modifications to function in the vastly different martian pressure environment. The two main hurdles are sound attenuation in Mars air, and transducer coupling inefficiency from density and sound speed mismatches with Mars air. The sound attenuation on Mars is significant, especially at ultrasonic frequencies. We have a simple model of the relevant phenomena to guide our choices to the optimal frequencies for Mars. The coupling between a transducer and the atmosphere is characterized by the match of their densities and sound speeds, or acoustic impedances, similar to index of refraction in optics. The Martian atmosphere has an acoustic impedance of about 1% that of the Earth. The commonly used (on Earth) piezo transducers lose about 110dB coupling with Mars air. Matching plates are unsuitable due to bandwidth limitations. Acoustic horns may aid in matching impedances. Capacitive transducers have an inherently low acoustic impedance, and are now becoming available in the frequency ranges needed for Mars. We are in the process of testing 3 styles

of cutting edge capacitive transducers in a simulated martian atmosphere anechoic chamber. Initial testing looks very favorable for producing a successful instrument for Mars. We will integrate the optimized transducer with Applied Technologies' electronics for Earth acoustic anemometers, with some possible modifications to again optimize performance at Mars. All of these issues are being addressed with respect to mass and power considerations. The goal of this project is to produce a proof of concept and functional design of an accurate, robust, versatile Martian anemometer with significantly greater capabilities than its predecessors.

Author

Mars Atmosphere; Sonic Anemometers; Mars Environment

20030066805 Los Alamos National Lab., NM, USA

Development and Testing of Laser-induced Breakdown Spectroscopy for the Mars Rover Program: Elemental Analyses at Stand-Off Distances

Cremers, D. A.; Wiens, R. C.; Arp, Z. A.; Harris, R. D.; Maurice, S.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

One of the most fundamental pieces of information about any planetary body is the elemental composition of its surface materials. The Viking Martian landers employed XRF (x-ray fluorescence) and the MER rovers are carrying APXS (alpha-proton x-ray spectrometer) instruments upgraded from that used on the Pathfinder rover to supply elemental composition information for soils and rocks to which direct contact is possible. These in-situ analyses require that the lander or rover be in contact with the sample. In addition to in-situ instrumentation, the present generation of rovers carry instruments that operate at stand-off distances. The Mini-TES is an example of a stand-off instrument on the MER rovers. Other examples for future missions include infrared point spectrometers and microscopic-imagers that can operate at a distance. The main advantage of such types of analyses is obvious: the sensing element does not need to be in contact or even adjacent to the target sample. This opens up new sensing capabilities. For example, targets that cannot be reached by a rover due to impassable terrain or targets positioned on a cliff face can now be accessed using stand-off analysis. In addition, the duty cycle of stand-off analysis can be much greater than that provided by in-situ measurements because the stand-off analysis probe can be aimed rapidly at different features of interest eliminating the need for the rover to actually move to the target. Over the past five years we have been developing a stand-off method of elemental analysis based on atomic emission spectroscopy called laser-induced breakdown spectroscopy (LIBS). A laser-produced spark vaporizes and excites the target material, the elements of which emit at characteristic wavelengths. Using this method, material can be analyzed from within a radius of several tens of meters from the instrument platform. A relatively large area can therefore be sampled from a simple lander without requiring a rover or sampling arms. The placement of such an instrument on a rover would allow the sampling of locations distant from the landing site. Here we give a description of the LIBS method and its advantages. We discuss recent work on determining its characteristics for Mars exploration, including accuracy, detection limits, and suitability for determining the presence of water ice and hydrated minerals. We also give a description of prototype instruments we have tested in field settings.

Author

Mars Exploration; Planetary Geology; Planetary Composition; Chemical Analysis; Laser-Induced Breakdown Spectroscopy

20030067195 Department of the Navy, Washington, DC

Underwater Vehicle Thermal Boundary Detection System

Barden, Robert J., Inventor; Feb. 8, 2001; 20 pp.; In English

Patent Info.: Filed 8 Feb. 2001; US-Patent-Appl-SN-09923257

Report No.(s): AD-D020066; No Copyright; Avail: Other Sources; , Microfiche

This invention relates to a device for thermal detection of seawater from within an unmanned underwater vehicle, thereby determining the position of a thermal boundary with respect to the vehicle. The current art for presetting underwater vehicles in search of a target is complicated by the presence of thermal layers beneath the water surface. A thermal layer can serve as an acoustic barrier by refracting transmitted sound waves (sonar), thereby isolating the target from the pursuing vehicle. The vehicle operator will thus attempt to position the vehicle by presetting the vehicle at the same depth as the submarine or at least on the same side of the thermal layer as its target to optimize its chance of achieving acoustic detection. A thermal sensor system is provided that includes a transport pipe having an intake and output for the passage of seawater. A thermal sensor is connected to the transport pipe for detecting the temperature of seawater within the transport pipe. Sensor electronics are provided in connection with the thermal sensor, the sensor electronics conditioning signals output by the thermal sensor. The selective sampling by the thermal sensor may either be intermittent or continuous according to system needs. Further, a control device is connected to the sensor electronics, acoustic equipment, and a depth sensor in connection with the maneuverable

vehicle allowing change of the vehicle's course in response to these inputs.

DTIC

Boundaries; Detection; Sea Water; Sound Detecting And Ranging; Underwater Vehicles; Thermoclines

20030067248 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA

Active Processor Scheduling Using Evolutionary Algorithms

Caswell, David J.; Dec. 2002; 191 pp.; In English; Original contains color illustrations

Report No.(s): AD-A413647; AFIT/GCS/ENG/02-36; No Copyright; Avail: CASI; [A09](#), Hardcopy

The allocation of processes to processors has long been of interest to engineers. The processor allocation problem considered here assigns multiple applications onto a computing system. With this algorithm researchers could more efficiently examine real-time sensor data like that used by USA Air Force digital signal processing efforts or real-time aerosol hazard detection as examined by the Department of Homeland Security. Different choices for the design of a load balancing algorithm are examined in both the problem and algorithm domains. Evolutionary algorithms are used to find near-optimal solutions. These algorithms incorporate multiobjective coevolutionary and parallel principles to create an effective and efficient algorithm for real-world allocation problems. Three evolutionary algorithms (EA) are developed. The primary algorithm generates a solution to the processor allocation problem. This allocation EA is capable of evaluating objectives in both an aggregate single objective and a Pareto multiobjective manner. The other two EAs are designed for fine turning returned allocation EA solutions. One coevolutionary algorithm is used to optimize the parameters of the allocation algorithm. This meta-EA is parallelized using a coarse-grain approach to improve performance. Experiments are conducted that validate the improved effectiveness of the parallelized algorithm. Pareto multiobjective approach is used to optimize both effectiveness and efficiency objectives. The other coevolutionary algorithm generates difficult allocation problems for testing the capabilities of the allocation EA. The effectiveness of both coevolutionary algorithms for optimizing the allocation EA is examined quantitatively using standard statistical methods. Also the allocation EAs objective tradeoffs are analyzed and compared.

DTIC

Algorithms; Scheduling; Signal Processing; Statistical Analysis

20030067253 Illinois Univ., Urbana, IL, USA

Design and Optimization of Passive and Active Imaging Radar

Blahut, Richard E.; Bresler, Yoran; Chew, Wend C.; Moulin, Pierre; Munson, David C.; Jun. 3, 2002; 42 pp.; In English

Contract(s)/Grant(s): F49620-98-1-0498

Report No.(s): AD-A413598; AFRL-SR-AR-TR-03-0167; No Copyright; Avail: CASI; [A03](#), Hardcopy

A selected set of papers documenting accomplishments and new findings are provided in the appendix. The paper compilation in the appendix is meant to be representative of the overall scope of the work and is not intended to be exhaustive. Complete references are given in the Publications section. Most of the papers listed may be downloaded for users at ece.gatech.edu/lanterma/pcl.

DTIC

Optimization; Radar Reception; Imaging Radar; Design Optimization

20030067270 Wayne State Univ., Detroit, MI

Sensitive Quantum-Dot Infrared Photodetector with Barrier-Limited Photoelectron Capture

Mitin, Vladimir; Sep. 30, 2002; 5 pp.; In English

Contract(s)/Grant(s): DAAD19-00-1-0426

Report No.(s): AD-A413605; 3-31496; ARO-41327.1-EL; No Copyright; Avail: CASI; [A01](#), Hardcopy

Our research on quantum-dot infrared photodetectors has been concentrated on increasing of photoconductive gain and responsivity. Innovative idea in design of sensitive quantum-dot infrared photodetector is to use a structure with quantum dots surrounded by repulsive potential barriers, which are created due to interdot doping. Spatial separation of the localized ground state and continuum conducting states of the electron increases significantly the photoelectron capture time and photoconductive gain. Large value of the gain results in high responsivity, which in turn improves detectivity and raises the device operating temperature.

DTIC

Quantum Dots; Infrared Radiation; Photometers

20030067427 Virginia Univ., Charlottesville, VA

Biomedical Application of Target Tracking in Clutter

Goobic, Adam P.; Welser, Michael E.; Acton, Scott T.; Ley, Klaus; Jan. 2001; 6 pp.; In English

Contract(s)/Grant(s): DAAD19-01-1-0594

Report No.(s): AD-A414250; ARO-41628.6-CI; No Copyright; Avail: CASI; [A02](#), Hardcopy

The movement of leukocytes (white blood cells) and their interaction with the endothelium (vessel wall) provides valuable information about the mechanism of inflammation and inflammatory disease. To investigate leukocyte motion within living animals, advanced automated tracking algorithms are requisite. The authors introduce military target tracking algorithms for use in tracking cell movement. Their dataset consists of intravital microscopy video recordings of rolling leukocytes in the mouse cremaster muscle observed via transillumination. They tracked 33 cells from 10 venules (small vessels). Five sets were TNF-alpha treated venules and five sets were untreated. The TNF-alpha treatment increases the inflammatory response and thus slows down the rolling cells. In 33 experiments, they compared the performance of five trackers that utilize video microscopy technology. The trackers tested include the centroid tracker, the correlation tracker, an enhanced centroid tracker, an enhanced correlation tracker, and an active contour (snake) tracker. Of the five methods, the snake tracker proved to be the most robust in terms of the highest percentage of frames tracked and the lowest root mean-squared error. This paper provides an overview of the five trackers and results from the 33 experiments. (1 table, 4 figures, 3 refs.)

DTIC

Leukocytes; Correlation Detection; Tracking (Position)

20030067472 California Univ., Berkeley, CA

Electronic Wavefunction Imaging and Spectroscopy in Metallic and Magnetic Nanostructures by Millikelvin Scanning Tunneling Microscopy

Davis, Seamus; McEuen, Paul L.; May 31, 2002; 8 pp.; In English

Contract(s)/Grant(s): DAAD19-99-1-0254

Report No.(s): AD-A414343; ARO-40005.1-PH; No Copyright; Avail: CASI; [A02](#), Hardcopy

Our research group is involved in the use of a millikelvin Scanning Tunneling Microscope (mk-STM), developed in previous grant periods.

DTIC

Electron Microscopes; Scanning Tunneling Microscopy; Wave Functions; Spectroscopy; Nanostructures (Devices); Imaging Techniques

20030067479

Biological Detection Systems for Electromagnetic Spectral Signatures

Welch, Ashley J.; May 13, 2003; 34 pp.; In English

Contract(s)/Grant(s): F49620-98-1-0480; Proj-3484

Report No.(s): AD-A414322; AFRL-SR-AR-TR-03-0181; No Copyright; Avail: CASI; [A03](#), Hardcopy

An interdisciplinary group of scientists was assembled to examine heat detection by biological systems with the goal of prototyping physical sensors based on the unique mechanisms found in nature. The focus of this research was heat detection systems of snakes and beetles. In conclusion, our evidence strongly supports the hypotheses that receptors in the pit organ of pit vipers are temperature receptors that are spectrally tuned based on the absorptive properties of the surrounding tissue and suggest that unique receptors with high sensitivity to low temperature stimulus are present in the pit membrane enabling this organ to exhibit a highly sensitive and unique response to thermal stimulus. Work is in progress in our laboratory to further elucidate the molecular and cellular basis of heating sensing capability of pit organ.

DTIC

Biological Effects; Spectral Signatures; Electromagnetic Radiation; Detection

20030067491 Illinois Univ. at Urbana-Champaign, Urbana, IL, USA

Tomographic Imaging on Distributed Unattended Ground Sensor Arrays

Brady, D. J.; Morrison, R.; Munson, D. C., Jr.; Stack, R.; May 14, 2002; 93 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-00-C-0099

Report No.(s): AD-A414400; No Copyright; Avail: CASI; [A05](#), Hardcopy

The objective of this project was to demonstrate tomographic data fusion from distributed ground sensor arrays. The project leveraged other DARPA work by the same researchers at the University of Illinois on the topic of interferometric digital imaging. The current program was oriented toward design of an array of imaging sensors, including both cameras and interferometric sensors, to accurately and robustly locate and track ground targets. Over the course of this project we designed and constructed five first-generation sensor modules. Four of these modules were fitted with 180-degree panorama video sensor heads, while the fifth used a sensor head consisting of a rotational shearing interferometer. Two modules were used in field tests with IR cameras replacing the visible-light sensor heads. In a second field test, four modules with visible-light CMOS cameras were used to demonstrate tomographic imaging of a human subject moving through a test environment. In addition, a smaller, low-power second generation module, based on the StrongArm processor, was designed, assembled and tested.

DTIC

Field Tests; Imaging Techniques; Multisensor Fusion; Tomography; Detectors

20030067576 National Inst. of Standards and Technology, Gaithersburg, MD, USA

Science Requirements for a Space Flight Experiment entitled CRITICAL VISCOSITY OF XENON

Berg, Robert F.; Moldover, Michael R.; December 07, 1993; 167 pp.; In English

Report No.(s): Rept-60009-DOC-006; No Copyright; Avail: CASI; [A08](#), Hardcopy

We propose to measure in low gravity the viscosity of xenon close to its critical point. The accuracy will be sufficient to eliminate uncertainties currently associated with the analysis of 1-g experiments. The measurements will provide the first direct observation of the predicted power-law divergence of viscosity in a pure fluid. The measurements will also strengthen Zeno's test of mode coupling theory by greatly increasing the reliability of the extrapolation of viscosity to low reduced temperatures. Our scientific objectives are described in more detail in one of the attached reports. The low-gravity experiment will be the final stage of a program whose completed ground-based stages are: (1) theoretical studies by one of the principal investigators (MRM) and coworkers, (2) critical viscosity measurements of binary liquid mixtures, (3) critical viscosity measurements of pure fluids in 1-g, and development of a suitable vibration-insensitive viscometer. Our technical approach is described in the draft Science Requirements Document. One of us (MRM) has reviewed opportunities for critical phenomena research in low gravity. Both of us were co-principal investigators in the Thermal Equilibration Experiment in the Critical Point Facility, flown on IML-1 in 1992. From this experience, and from the technical maturity of our ground-based work, we believe our critical point viscometer is ready for development as a flight experiment.

Author

Viscometers; Spaceborne Experiments; Xenon; Microgravity; Critical Point

20030067579 CALIFORNIA UNIV RIVERSIDE CENTER FOR RESEARCH IN INTELLIGENT SYSTEMS, Riverside, CA, USA

Learning Integrated Visual Database for Image Exploitation

Bhanu, Bir; Nov. 25, 2002; 22 pp.; In English

Contract(s)/Grant(s): F49620-97-1-0184

Report No.(s): AD-A413389; CRIS-AFOSR-RPT-02; AFRL-SR-AR-TR-02-0442; No Copyright; Avail: CASI; [A03](#), Hardcopy

The research summarized in this report is aimed at developing image understanding (IU) algorithms and systems that have performance prediction and learning capabilities and that can improve their performance with experience, in terms of quality of results, processing speed and matching with the user's perception. The following scientific problems are addressed: (a) Fundamental theory for predicting the performance of object recognition systems and its validation on SAR images, (b) Automatic methods for recognizing articulated, occluded and configuration variants of targets in SAR images and video, (c) Adaptive learning integrated target recognition algorithms/systems, and (d) Learning visual concepts in images/videos with user interaction and experience over time. The research presented makes a significant contribution to real-world applications which require robust high performance automated systems that can recognize objects in reconnaissance imagery acquired under dynamically changing conditions and for systems that can efficiently extract meaningful information from enormous image/video databases.

DTIC

Target Recognition; Imagery

20030067624 Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau, Germany

Optical Depth Retrievals from HRSC Stereo Images

Hoekzema, N. M.; Gwinner, K.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 2003074858; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Mars Express is due to arrive in orbit around Mars during the last days of 2003. A primary task of its mission is to map Mars in stereo with the High Resolution Stereo Camera (HRSC) at a spatial resolution of up to 12 m. The Martian atmosphere contains large amounts of dust and other aerosols that scatter light and influence the images. Therefore, image analysis requires careful consideration of these atmospheric effects. An essential parameter to consider is the optical depth. It will be possible to map the optical depth of the Martian atmosphere from HRSC stereo images by analyzing contrast differences. Software to this purpose has been developed at the Max-Planck Institute for Aeronomy in Lindau Germany. We present examples of optical depth-retrievals from airborne HRSC-A images of a region in the French Alps.

Author

Image Analysis; Mars Atmosphere; Mars Surface; Optical Thickness; Planetary Mapping

20030067625 Fluor Daniel Hanford, Inc., Richland, WA, USA

NUPRO Process Vent/MCO Check/Relief Valve-Prevent Backflow from Process Vent into MCO

Miska, C. R.; Sep. 25, 2001; 24 pp.; In English

Report No.(s): DE2003-807334; No Copyright; Avail: Department of Energy Information Bridge

This Engineering Change Notice (ECN) issues Revision 6 of SNF-3933 (CGI Dedication Package) NUPRO Process Vent/MCO Check/Relief Valve-Prevent Backflow from Process Vent into MCO. This revision is being made to permit the upgrade of the NUPRO valves presently in the Warehouse.

NTIS

Safety; Relief Valves; Radiation Shielding; Test Facilities

36

LASERS AND MASERS

Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also *76 Solid-State Physics*.

20030066422 Cleveland State Univ., Cleveland, OH, USA

A Theoretical Light Scattering Model of Nanoparticle Laser Tweezers

Lock, James A.; June 18, 2003; 2 pp.; In English

Contract(s)/Grant(s): NAG3-2774; No Copyright; Avail: CASI; [A02](#), Diskette; [A01](#), Hardcopy

Accomplishments this reporting period include: 1. derived, programmed, checked, and tested the Mie light scattering theory formulas for the radiation trapping force for both the on-axis and off-axis geometry of the trapping beam plus trapped spherical particle; 2. verified that the computed radiation trapping force for a freely propagating focused Gaussian laser beam incident on a spherical particle agrees with previous published calculations; 3. compared the small particle size and large particle size limits of the Mie calculation with the results of Rayleigh scattering theory and ray scattering theory, respectively and verified that the comparison is correct for Rayleigh scattering theory but found that ray theory omits an important light scattering effect included in the Mie theory treatment; 4. generalized the calculation of the radiation trapping force on a spherical particle in the on-axis geometry from a freely propagating focused Gaussian laser beam to the realistic situation of a Gaussian beam truncated and focused by a high numerical aperture oil-immersion microscope objective lens and aberrated by the interface between the microscope cover slip and the liquid-filled sample volume; and 5. compared the calculated radiation trapping force for this geometry with the results of previously published experiments and found that the agreement is better than when using previously developed theories.

Derived from text

Nanoparticles; Light Scattering; Mie Scattering; Radiation Trapping; Trapped Particles

20030066925

Laser Induced Plasma Spectroscopy and Applications

Feb. 28, 2003; 250 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0065

Report No.(s): AD-A413904; No Copyright; Avail: CASI; [A11](#), Hardcopy

The OSA topical meetings that received support under this grant provided a forum for researchers in various specialty areas to meet and share ideas and technology in their fields. Following are the meetings that were supported by this grant: 1. Advanced Solid State Lasers - This meeting provided a forum for leading edge results in the fields of solid state lasers, laser materials, nonlinear optical materials and high power diode lasers. 2. Laser Applications to Chemical and Environmental Analysis - This meeting presented and discussed advances in the use of lasers for chemical analysis and environmental monitoring. 3. Biomedical Optics - This meeting was composed of three meetings that offered a unique venue to present and discuss recent research activities and developments in the field of lasers and optics in biomedicine. 4. Ultrafast Phenomena - This meeting brought together a multidisciplinary group sharing a common interest in the generation of ultrashort pulses in the picosecond, femtosecond, and attosecond regimes and their application to studies of ultrafast phenomena in physics, chemistry, biology, material sciences and electronics. 5. Nonlinear Optics%- This meeting provided and international forum for discussion of all aspects of nonlinear optics, including new phenomena, novel devices, advanced materials and applications. 6. Nonlinear Guided Waves and their Applications - This meeting emphasized on development of new ideas and novel techniques in the areas of materials, fabrication, devices , applications and nonlinear theory. 7. Laser Induced Plasma Spectroscopy and Applications -This Meetings focused on major advances in LIBS fundamentals, instrumentation and applications and featured new commercial laboratory LIBS systems and advanced components, as well as field portable systems.

DTIC

Laser Applications; Laser-Induced Breakdown Spectroscopy; Plasmas (Physics); Medical Science

20030066954 Mitre Corp., McLean, VA

High Power Lasers

Hammer, D.; Cornwall, J.; Drell, S.; Jeanloz, R.; Lelevier, R.; Apr. 2003; 92 pp.; In English; Original contains color illustrations

Report No.(s): AD-A413819; JSR-02-335; No Copyright; Avail: CASI; [A05](#), Hardcopy

In Summer 2002, JASON undertook a study for the National Nuclear Security Administration (NNSA) of the prospective scientific value of high energy petawatt (HEPW) lasers to the NNSA's Stockpile Stewardship Program (SSP). Our charge was principally to look at the potential value of such lasers to achieving an increased understanding of nuclear weapons physics, but with attention paid to the impact of HEPW lasers on unclassified new science, including inertial-confinement fusion (ICF), astrophysics, and high-field physics. We were also asked to assess the plan for petawatt laser facility development and research activities that is being developed by NNSA's major laboratories, including the technical and programmatic risks associated with it. The main report presents our detailed response to the study charge; this first chapter summarizes our findings,

DTIC

High Power Lasers; Inertial Confinement Fusion; Stockpiling

20030066976 Duke Univ., Durham, NC

A Millimeter-Wave Photonic Crystal Laser

Everitt, Henry O.; May 20, 2002; 8 pp.; In English

Contract(s)/Grant(s): DAAH04-93-D-0002

Report No.(s): AD-A413755; ARO-37762.7-PH-SR; No Copyright; Avail: CASI; [A02](#), Hardcopy

Ultrasmall optical pumped far infrared laser cavities were constructed using defect cavities in a purely dielectric photonic crystal. Microwave measurements were performed on scale model photonic crystals to understand the performance of the cavities as a function of cavity size, isolation, and dielectric loss. In addition, continuous wave and ultrafast optical measurements of wide bandgap semiconductors were performed. Refractive indices were measured for AlGaIn comprehensively for the first time. Measurements of conduction band offsets of AlGaIn were attempted. The electron capture time in InGaIn multiple quantum well laser structure was found to be approximately 0.5 Ps when electrons are optically injected near the barrier band edge. Coherent oscillations of zone folded longitudinal acoustic phonons were observed, and the means for their generation were studied. Finally, these phonons were coherently controlled, and complete cancellation of optically generated acoustic phonons was demonstrated for the first time.

DTIC

Laser Cavities; Crystal Defects; Millimeter Waves; Photon Beams

20030067178 Georgia Tech Research Inst., Atlanta, GA, USA

Modeling and Simulation of Multiwavelength Conversion in Semiconductor Laser Optical Amplifiers for Logic, Switching, Communication

Blumenthal, Daniel J.; Jun. 30, 1998; 4 pp.; In English

Contract(s)/Grant(s): F49620-95-1-0466; Proj-3484

Report No.(s): AD-A413739; AFRL-SR-AR-TR-03-0117; No Copyright; Avail: CASI; [A01](#), Hardcopy

This grant was an AASERT funded project that supported one graduate student in association with parent grant F49620-96-1-0168. The program achieved several wavelength conversion demonstrations via four-wave mixing in semiconductor optical amplifiers (SOAs) and computer simulation to describe multiwavelength propagation in SOAs with wavelength dependent gain and gain saturation. They studied the effect of generation of composite dynamic gratings on the FWM wavelength conversion process and demonstrated the following FWM milestones: single channel conversion of 12, Gbps pseudo-random bit sequence (PRBS) data, single pump/multichannel probe conversion of four 2.5 Gbps channels a simultaneous conversion of two 2.5 Gbps data channels using two spectrally segmented FWM process within a single amplifier. The later demonstration represents a significant milestone in the direction of our program objectives. The team also implemented several models for multiwave propagation in SOAs that account for wavelength dependent gain asymmetry, saturation power, small signal modulation, and pulse propagation.

DTIC

Semiconductor Lasers; Models; Simulation; Wavelengths; Frequency Converters; Amplifiers; Lasers

20030067210 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA

Building Blocks for Time-Resolved Laser Emission in Mid-Infrared Quantum Well Lasers

Mounce, Gabriel D.; Mar. 2003; 107 pp.; In English; Original contains color illustrations

Report No.(s): AD-A413526; AFIT/GE/ENP/03-01; No Copyright; Avail: CASI; [A06](#), Hardcopy

The objective of this research is to improve the performance of mid-infrared semiconductor quantum-well lasers. Lasers operating in the mid-infrared are useful for many Air Force applications which include infrared (IR) countermeasures in particular. Countermeasure applications require lasers that are compact, and able to emit at high powers while operating at room temperature. Limits to power increases are seen in the transverse modal development of laser oscillation. These modes typically form in the waveguiding active region contributing to the laser output. However, competing modes outside of this region also develop when the confining structural layers have the right characteristics. These competing modes may draw power away from the main lasing mode, causing efficiency to drop. Therefore, theoretical models indicate that these 'ghost' modes should be extinguished. The goal of this work is to incorporate antimony-based semiconductor laser devices into a time-resolved photoluminescence (TRPL) experiment to examine modal development immediately after excitation. TRPL utilizes a non-linear wave mixing technique known as frequency upconversion to resolve sub-picosecond luminescence occurrences after excitation. Modification to the experiment is performed to produce laser emission from five mid-IR semiconductor laser samples. Both spontaneous and stimulated emission spectra are recorded. Alignment of the experiment is also carried out to produce upconversion of the PL signal to prepare for the incorporation of laser emission.

DTIC

Infrared Radiation; Laser Outputs; Quantum Well Lasers; Semiconductor Lasers; Time Dependence; Indium Arsenides; Photoluminescence

20030067411 California Univ., Irvine, CA

Acquisition of an All-Solid State Femtosecond Laser System

Apkarian, V. A.; May 13, 2003; 3 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0319; Proj-2303

Report No.(s): AD-A414422; AFRL-SR-AR-TR-03-0182; No Copyright; Avail: CASI; [A01](#), Hardcopy

We have successfully constructed a rather unique femtosecond laser system, which has already been quite productive. The system was designed around a commercial pump source, the Clark MXR-2001 system, which is a diode-pumped, additive chirp mode locked fiber laser, regeneratively amplified to produce 775 nm pulses of ~ 160 fs, 800mW, at 1KHz. The output of the pump laser is split successively with 50% beam splitters, to use ~ 200 mW beams to pump two home-built Non-collinear Optical Parametric Amplifiers (NOPA). The latter have innovative details, to generate final outputs of 10 microns/pulse, at 1 KHz, with pulsewidths of 10-30 fs, in the entire visible spectrum. The system enables nonlinear multicolor, multi-beam measurements, of quantum coherences, with experimental time resolution of 14 fs, in notoriously difficult measurements of 4-wave and 6-wave mixing in condensed media. The design of the NOPA is illustrated. The pump entering the NOPA is split between two arms, 4% is used to generate white light in a 200micronm sapphire disk, while the rest is used to double in a

BBO x-tal, then to pump the NOPA x-tal to generate super radiance. The white light is volume matched with the superradiance on a 14 deg. incline, and the time-spectral overlap of the chirped white light is amplified. The single delay line of TSI in the figure is sufficient to tune the color of the output. The bandwidth of the output is controlled by the chirp in the white light. Typically, bandwidths that can sustain 10 fs operation can be obtained by adjusting the white light optics. While ultrashort pulses are the aim of our setup, in many measurements longer pulses are desired. This can be managed by inserting a dispersion element in the white light arm, a water cell or an SF10 blank of variable length is used to this end.

DTIC

Laser Pumping; Solid State Lasers; Optical Properties; Light Amplifiers; Beam Splitters

20030067444 Wyoming Univ., Laramie, WY

Space-Based, Long-Distance Laser Pointing and Tracking

McInroy, John E.; Hamann, Jerry C.; Feb. 5, 2002; 25 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAG55-98-1-0007

Report No.(s): AD-A414314; ARO-37856.5-EG; No Copyright; Avail: CASI; [A03](#), Hardcopy

To rapidly and reliably acquire and maintain a laser on a long-distance, space-based target (or receiver), a pointing system capable of locking onto the position of a target (or receiver) over a wide field-of-view has been developed. The pointing/tracking system consists of a highly instrumented hexapod platform, a six-legged parallel kinematic machine capable of six degree-of-freedom (DOF) motion. This architecture is lightweight, highly fault tolerant, and capable of absorbing vibrations in all six DOF so off-axis vibrations do not induce on-axis errors through structural flexibilities. Accelerometers are used to measure ambient vibrations and reject them using an active control system. Optical sensors are used to measure pointing errors and reject them using decoupled, fault tolerant feedback control techniques. New models and control algorithms have been developed utilizing these measurements to provide tracking in a fault tolerant manner over a wide field-of-view. The control advances include: 1) Design criteria to maximize the hexapod's performance; 2) Decoupled control algorithms that result in high bandwidths for any rigid payload; 3) Optimal methods of reconfiguring the control following failures; 4) Methods for managing the overlapping capabilities of coarse and fine stages; 5) Adaptive algorithms to enhance rejection of monotone vibrations; and 6) Estimation algorithms to accurately identify the payload. Six DOF vibrations have been generated using a second hexapod, and robust force control algorithms have been employed to de-sensitize its control to payload structural dynamics.

DTIC

Tracking (Position); Space Based Radar; Mathematical Models; Optical Tracking; Optical Measuring Instruments

20030067449 Massachusetts Inst. of Tech., Cambridge, MA

Coherent Control over Excitations and Signals in Semiconductors

Nelson, Keith A.; May 2002; 3 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0431

Report No.(s): AD-A414329; ARO-38802.1-PH; No Copyright; Avail: CASI; [A01](#), Hardcopy

The underlying technology for THz polaritonics - programmable, solid-state, THz-bandwidth signal processing - was developed. Two primary steps enabled this achievement. First, an automated spatiotemporal femtosecond pulse shaping system, through which ultrafast laser pulses could be directed at specified times to specified locations (i. e. to specified addresses), was created. Second, the system was applied to spatiotemporal coherent control over THz-frequency polariton waves (which serve as ultrahigh-bandwidth signals) in crystalline solids. The methods open the way to a versatile electro-optic signal processing platform in which the THz-bandwidth signals are generated, propagated, manipulated, and read out, all without loss of bandwidth. The results of this project have spawned numerous further refinements of polaritonics technology as well as advances toward fundamental and practical applications.

DTIC

Signal Processing; Coherence; Pulsed Lasers; Semiconductors (Materials); Electro-Optics

MECHANICAL ENGINEERING

Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see *63 Cybernetics, Artificial Intelligence, and Robotics*; and *54 Man/System Technology and Life Support*.

20030066293 Fluor Daniel Hanford, Inc., Richland, WA, USA

Evaluation of Tin Plating for Multi-Canister Overpack Seals

Graves, C. E.; Dec. 07, 2000; 15 pp.; In English

Report No.(s): DE2003-805626; HNF-6468; No Copyright; Avail: Department of Energy Information Bridge

The Multi-Canister Overpack (MCO) incorporates plated seals for use with (1) the port cover plates, (2) process valves of the shield plug, and (3) test plug of the cover cap. These seals are required to maintain leakage rates in the cover cap to test plug seal. The seals are manufactured by EG&G division of Perkin Elmer. Currently, the MCO design calls for use of silver or gold plated seals in these locations. The seal plating materials are deposited on Inconel 718 or X-750 substrates. Some of these seals are reused several times in service on the MCO. The MCO manufacturer has built several MCOs and is in the leak testing stage and has had great difficulty obtaining acceptable leakage rates at their plant in Camden, New Jersey. The seal manufacturer was called in to evaluate the situation and now the seal manufacturer recommends tin plated seals. This evaluation examines the Corrosion resistance and thermal stability often plating on the seals. The attached letter report evaluates the use of tin plating on the Multi-Canister Overpack (MCO) seals used with the port cover plates, process valves, and test plugs. Topics examined included corrosion resistance, radiation resistance, and elevated temperature behavior of the tin plating in the expected MCO environments.

NTIS

Corrosion Resistance; Radiation Tolerance; Thermal Stability; Seals (Stoppers); Tin; Plating

20030066874 Cornell Univ., Ithaca, NY, USA

Simulating Fatigue Crack Growth in Spiral Bevel Pinion

Ural, Ani; Wawrzynek, Paul A.; Ingraffia, Anthony R.; August 2003; 47 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAS3-1993; WBS-22-708-90-01

Report No.(s): NASA/CR-2003-212529; NAS 1.26:212529; E-14091; ARL-CR-0531; No Copyright; Avail: CASI; [A03](#), Hardcopy

This project investigates computational modeling of fatigue crack growth in spiral bevel gears. Current work is a continuation of the previous efforts made to use the Boundary Element Method (BEM) to simulate tooth-bending fatigue failure in spiral bevel gears. This report summarizes new results predicting crack trajectory and fatigue life for a spiral bevel pinion using the Finite Element Method (FEM). Predicting crack trajectories is important in determining the failure mode of a gear. Cracks propagating through the rim may result in catastrophic failure, whereas the gear may remain intact if one tooth fails and this may allow for early detection of failure. Being able to predict crack trajectories is insightful for the designer. However, predicting growth of three-dimensional arbitrary cracks is complicated due to the difficulty of creating three-dimensional models, the computing power required, and absence of closed-form solutions of the problem. Another focus of this project was performing three-dimensional contact analysis of a spiral bevel gear set incorporating cracks. These analyses were significant in determining the influence of change of tooth flexibility due to crack growth on the magnitude and location of contact loads. This is an important concern since change in contact loads might lead to differences in SIFs and therefore result in alteration of the crack trajectory. Contact analyses performed in this report showed the expected trend of decreasing tooth loads carried by the cracked tooth with increasing crack length. Decrease in tooth loads lead to differences between SIFs extracted from finite element contact analysis and finite element analysis with Hertz contact loads. This effect became more pronounced as the crack grew.

Author

Crack Propagation; Spiral Bevel Gears; Fatigue Life

20030067483 Naval Academy, Annapolis, MD

Advanced Machine Controller Retrofit with Acoustic Emission Feedback

Tink, Roland R.; Jan. 1997; 62 pp.; In English

Report No.(s): AD-A414377; USNA-252; No Copyright; Avail: CASI; [A04](#), Hardcopy

Current advanced milling uses Computer Numerical Control (CNC) to make complex shapes. The milling process uses

a high speed rotating tool to remove material from a larger block until the desired workpiece shape remains. These shapes are frequently created by Computer Aided Design (CAD) and translated into a tool path by Computer Aided Machining (CAM). This tool path defines the mill commands used to move the end mill to create the part. Since CNC technology today uses hardwired equipment, the mill command structure cannot be updated or modified without removing the controller. A possible solution is the implementation of the Personal Computer (PC) on the shop floor. PC's utilized as controllers for milling machine have been developed over the late 1980's and 1990's. A PC can easily handle the computing tasks of mill control, while also having the flexibility of being upgradable in implementing that control. New control codes or algorithms can be implemented by using new software, without the prohibitive cost of changing expensive control equipment. In this project, an Acoustic Emission (AE) sensor returned strain information to the PC. This strain information, which is referenced to material removal, and material removal rate, is indicated by a Root-Mean-Square (RMS) of the AE signal. From the RMS level, the PC adjusted feedrate accordingly. By controlling the feedrate, the PC can speed up or slow down the end mill trajectory. This process decreases overall milling time and/or improves surface quality by adjusting to the changing parameters during the milling process.

DTIC

Acoustic Emission; Controllers; Feedback; Computer Aided Design; Milling Machines

39

STRUCTURAL MECHANICS

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structures. For applications see *05 Aircraft Design, Testing and Performance*; and *18 Spacecraft Design, Testing and Performance*.

20030067245 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA

Development of a Simplified Sustainable Facilities Guide

Hargy, David F.; Apr. 18, 2003; 252 pp.; In English; Original contains color illustrations

Report No.(s): AD-A413637; AFIT/GEE/ENV/03-12; No Copyright; Avail: CASI; [A12](#), Hardcopy

The Air Force has adopted the USA Green Building Council's Leadership in Energy and Environmental Design (LEED trade mark) Green Building Rating System as the preferred self-assessment metric for sustainable development. LEED (trade mark) is designed for new construction and major renovations, and, within the Air Force, is most applicable for Military Construction (MILCON) projects. The Air Force Center for Environmental Excellence developed the Air Force Sustainable Facilities Guide to provide guidance and strategies to meet LEED(trade mark) requirements. The Air Force has not adopted a sustainable development guide or rating system that is most applicable for construction projects that are relatively low (compared to MILCON projects) in cost or complexity. This research developed a Simplified Sustainable Facilities Guide that can identify and assess sustainable development opportunities in all facility and infrastructure projects. This guide, modeled after the Air Force Sustainable Facilities Guide, simplifies most LEED(trade mark) requirements to reduce the time, cost, and expertise level required to incorporate sustainable development concepts while preserving the intent of LEED(trade mark). This guide is designed to quickly identify opportunities in projects that are relatively low in cost and complexity; where using the more robust LEED(TM). requirements may not be justified. The Simplified Sustainable Facilities Guide, in conjunction with existing Air Force guidance, provides a means to address sustainable development issues in all facility and construction projects regardless of cost or complexity.

DTIC

Construction Materials; Engineering; Military Air Facilities; Defense Program

20030067264 TRC Environmental Consultants, Inc., Irvine, CA, USA

Environmental Impact Analysis Process. Environmental Assessment for Replacement Medical Clinic 61st Medical Squadron, Los Angeles Air Force Base

Mason, Robert; Trindle, Carolyn; Bahr, Jane; Brugger, Ron; Dec. 1999; 46 pp.; In English

Contract(s)/Grant(s): Proj-99-269

Report No.(s): AD-A413679; No Copyright; Avail: CASI; [A03](#), Hardcopy

The Environmental Assessment (EA) for the new Medical Clinic at Los Angeles Air Force Base (AFB) assessed the potential environmental impacts related to construction and operation of the new facility. The new Medical Clinic is designed to provide primary care, aeromedical services, ancillary services, dental, mental health, patient services and command/administrative functions. This clinic will be a 48, 000-square-foot facility that could serve an anticipated 8,100 enrollees. It

could provide an estimated 8,100 prescriptions per month. The facility will be constructed on a 5-acre site currently used for the existing facility. Its phased construction plan will enable the existing facility to remain fully operational until the new clinic is completed. Phase I involves demolition of three tennis courts and two buildings, then construction of the new clinic. Phase II involves demolition of the existing facility and construction of a new parking area.

DTIC

Environmental Surveys; Construction

20030067364 Swedish Defence Research Establishment, Tumba

Criteria of Collapse for Pressure Loaded Structure Panels

Gustaffson, M.; Apr. 2002; In Swedish

Report No.(s): PB2003-104339; FOI-R-0501-SE; No Copyright; Avail: National Technical Information Service (NTIS)

To be able to estimate when a structure panel will collapse it is required that one can calculate the stresses or strains that occur within the panel. A variety of collapse mechanisms are described and proposals of how to give criteria of collapse in simple cases are given. The structure panels are modeled as beams or systems of beams in order to simplify the calculations and reduce the calculation time. Static loads of collapse are given for some elementary cases of elasto-plastic beams. In order to estimate loads and deformations in structure panels exposed to dynamic pressure loads the old code has been modernized and in some parts been modified to be usable again. The stresses, strains, accelerations and deformations calculated by the program can be used to check if any limiting value has been exceeded. The program itself has no criteria of collapse implemented, which means that the user has to decide the limits. Another possible future use of the code could be to check if any vital parts attached to the panel are subjected to damaging accelerations or deformations.

NTIS

Collapse; Loads (Forces); Panels

42

GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see *categories 42 through 48*.

20030067013 City of Buenos Aires, Buenos Aires, Argentina

Potential Impact Sites in Southern Argentina: Simple Craters?

Rocca, M. C. L.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Southern part of Argentina has a total surface of 786,112 square kilometers. It is composed of five Provinces: Neuquen, Rio Negro, Chubut, Santa Cruz and Tierra del Fuego. So far no impact sites has been reported in this wide zone. As a part of an on-going project to discover meteorite impacts, this area was investigated by the author through the examination of 76 color LANDSAT satellite images (1:250,000 - resolution = 250 meters) at the Instituto Geografico Militar (IGM) (=Military Geographic Institute) of Buenos Aires city. When a potential candidate was found a more detailed study of images was done. LANDSAT color images; scale 1:100,000 (IGM), and aerial photographs; scale 1:60,000 (IGM), were then consulted. A few potential simple impact craters were identified. The co-ordinates given are those of the two corners of a rectangle enclosing the site: the upper left and the lower right points. Further evaluation of these sites is in progress.

Derived from text

Argentina; Satellite Imagery; Structural Properties (Geology); Meteorite Craters

20030067015 Academy of Sciences (USSR), Moscow, USSR

Cratering Process After Oblique Impacts

Shuvalov, V. V.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

It is well known that most impacts are oblique, and most craters are circular. Nevertheless, there are several markers, which can indicate the obliquity of impacts, and even allow estimating an impact angle. The main indication of the obliquity is ejecta distribution. The distal ejecta formed at the beginning of excavation stage is the most asymmetrical feature and is commonly used to determine an impact angle and direction. However, the distal ejecta is also the most short-living feature

(because of a small thickness of a layer of deposits) and often can not be used to estimate the obliquity.

Author

Cratering; Ejecta; Craters; Excavation

20030067024 Tartu Univ., Tartu, Estonia

Impact Induced Hydrothermal System at Kaerdla Impact Crater: Development and Biological Consequences

Versh, E.; Kirsimäe, K.; Joeleht, A.; Plado, J.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Kinetic energy released to the target by a meteorite impact results in the heating-to-melting and vaporization of the projectile and target rocks which then starts to cool to the ambient conditions. In dry environments the heat loss occurs mainly by conduction and radiation transfer. If the water is present at the crater site the cooling can also include convective heat transfer by a hydrothermal circulation system. Evidences of such system have been found at many terrestrial craters and it is suggested for extraterrestrial craters as well. Impact induced hydrothermal systems are important to study in many aspects. First, cooling and development of such systems is still at debate. In most described cases these systems form in and around the craters central uplift (e.g. Kaerdla, Puzhes-Katunki, Siljan) whereas in others they are recognized only at the crater rims (e.g. Haughton). Secondly, mineral deposits formed and/or modified by these hydrothermal fluids represent significant economical interest (e.g. Sudbury). Thirdly, in recent years profound studies have been made on thermal side of the impacts, as they may create new environments for life to evolve, which is of great interest in respect to search for possible extraterrestrial life. In this contribution we report a complex geological observation, modeling and biological study about post-impact cooling of a medium-to-small scale Kaerdla impact crater in Hiiumaa Island, Estonia. The Kaerdla crater is 4 km in diameter and approx. 540 m deep with a central uplift exceeding 150 m height above the crater floor. It formed in a shallow (less than 100 m deep) epicontinental Ordovician sea approx. 455 Ma ago into a target composed of thin siliciclastic and carbonate sediments covering crystalline basement.

Author

Hydrothermal Systems; Impact; Craters; Kinetic Energy

20030067033 Muenster Univ., Germany

Al-rich Orthopyroxenes in Impact Melt Coatings of Gneiss Bombs from Popigai, Russia: New ATEM Data

Seydoux-Guillaume, A.-M.; Deutsch, A.; Wirth, R.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Original contains black and white illustrations

Contract(s)/Grant(s): DFG-DE-401/18-1; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Popigai is an excellently preserved complex impact crater with a diameter of approx. 100 km. In suevites and fine-grained fragmental breccias, numerous gneiss bombs, up to 40 cm across, occur. These gneiss bombs are coated with less than 3 cm thick layers of impact melt which carry information about the time-temperature path that the bombs experienced between ejection and deposition as part of the allogenic breccias. The coatings consist of various melt layers, ranging from fresh, colorless to brownish, nontransparent crypto-crystalline glasses. Geochemical and Sr, Nd isotopic data of the coatings point to quite different precursor materials for the glass.

Author

Craters; Impact Melts; Breccia; Coatings; Crystallinity; Geochemistry

20030067035 Witwatersrand Univ., Johannesburg, South Africa

Chronology of Impact-related Deformation in the Central Uplift of the Vredefort Impact Structure, South Africa

Wieland, F.; Gibson, R. L.; Reimold, W. U.; Lana, C.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

This study presents results of a structural investigation of the inner parts of the central uplift of the Vredefort impact structure. A 20-25 km thick crustal section has been rotated on-end to form the central uplift, which displays evidence of increasing shock deformation towards the center of the dome. The dome possesses a polygonal geometry, with the polygon segments separated by zones of asymmetric folding and radial oblique-slip faulting. The strong orientation asymmetry in the northwestern and southeastern parts is attributed to a dipping pre-impact sequence. Multiple joint sets are intensely developed in all rock types and display predominantly normal-slip displacements, consistent with radial and tangential collapse of the

central uplift. These joints may post-date shock-related pseudotachylitic breccia veins, although the latter commonly appear to have crystallized only after joint formation.

Author

Chronology; Boundary Layer Separation; Breccia; Deformation; Impact; Crusts

20030067038 Museum fuer Naturkunde, Berlin, Germany

Impact Melt Rocks in the ‘Cretaceous Megablock Sequence’ of Drill Core Yaxcopoil-1, Chicxulub Crater, Yucatan, Mexico

Wittmann, A.; Kenkmann, T.; Schmitt, R. T.; Hecht, L.; Stoeffler, D.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations

Contract(s)/Grant(s): DFG-KE732/8; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Yaxcopoil borehole (Yax-1) penetrates below the impactite units through 600 m of Cretaceous sediments (894.9 m - 1510.9 m). These units are regarded as a displaced ‘megablock’. This stratified sequence was intruded by suevitic dikes, impact melt dikes and several clastic, polymict dikes. We present preliminary petrographic and geochemical investigations of these dikes.

Author

Impact Melts; Meteorite Craters; Cretaceous Period; Petrography; Geochemistry

20030067039 NASA Johnson Space Center, Houston, TX, USA

Experimentally Shock-loaded Anhydrite: Unit-Cell Dimensions, Microstrain and Domain Size from X-Ray Diffraction

Skala, R.; Hoerz, F.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations

Contract(s)/Grant(s): HPRI-1999-CT-00004; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Cretaceous Tertiary (K/T) boundary is traditionally associated with one of the most dramatic mass extinctions in the Earth history. A number of killing mechanisms have been suggested to contribute to the widespread extinctions of Cretaceous biota at this boundary, including severe, global deterioration of the atmosphere and hydrosphere from the shock-induced release of CO₂ and SO(x) from carbonate- and sulfate-bearing target rocks, respectively. Recently carried out calculations revealed that the global warming caused by CO₂ release was considerably less important than the cooling due to SO(x) gases release during the Chicxulub impact event. Considering apparent potential importance of the response of sulfates to the shock metamorphism, relative lack of the data on shock behavior of sulfates as well as some general difficulties encountered during thermodynamic modeling of the shock-induced CO₂ loss from carbonates we subjected anhydrite to a series of shock experiments designed for complete recovery of the shocked material. We report here on the detail X-ray diffraction analysis of seven samples that were subjected to experimental shock-loading from 10 to 65 GPa.

Author

Cretaceous-Tertiary Boundary; Carbon Dioxide; Sulfates; Metamorphism (Geology); X Ray Diffraction

20030067041 Bayreuth Univ., Germany

Phase Relations in TiO₂ at Elevated Pressures and Temperatures

Dubrovinsky, L.; Dubrovinskaia, N.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Titanium dioxide (TiO₂) occurs in nature as the accessory minerals rutile, anatase, and brookite. Rutile is the most abundant TiO₂ polymorph in nature and is an important minor constituent in natural rocks. It is isostructural with stishovite. Hence, its response to static and dynamic pressure is important for understanding phase transition mechanisms in SiO₂ and TiO₂ during subduction of crustal limbs to the Earth's mantle and during natural shock events. Recently the first natural occurrence of a shock-induced dense -PbO₂-structured polymorph of TiO₂ was found in gneisses from the Ries crater in Germany. The phase relations in TiO₂ system at elevated pressures and temperatures are not fully understood and it motivated us to conduct a series of experiments in laser- or electrically-heated diamond anvil cells (DACs). Anatase or rutile (99.99% TiO₂) was used as a starting material. At applied pressures of about 12 GPa or above, both rutile and anatase transform to the baddeleyite (MI, P21/c) phase. On further compression, reflections due to the MI phase could be followed to over 60 GPa. At pressures above about 45 GPa, however, the quality of the diffraction pattern decreased drastically and at about 60 GPa, the material became translucent. We observed that at pressures above 50 GPa, TiO₂ absorbs Nd:YAG laser radiation and the

laser-heated areas of the sample became black. After heating at 1600-1800 K by laser for 40 minutes at pressures between 60 and 65 GPa, the material transformed to a new phase. All X-ray reflections of the new phase could be indexed in an orthorhombic cotunnite-type cell. Transformations observed by X-ray diffraction were confirmed by Raman spectroscopy. Although in situ high pressure and temperature Raman spectroscopy in DACs does not provide direct structural information, this method is much faster and experimentally easier for realisation than X-ray powder diffraction. Raman signals from all titania phases are strong and clearly distinguishable and we used Raman spectroscopy to follow some phase relations in TiO₂ at high-P,T conditions. Particularly, we found that slope of phase boundary between -PbO₂-type TiO₂ and MI phase (77(3) K/GPa) is significantly lower than that earlier reported by Tang and Endo (1993) (188 K/GPa). Our combined theoretical and experimental investigations have led to the discovery of new polymorphs of titanium dioxide, where titanium is seven-coordinated to oxygen in the orthorhombic OI (Pbca) structure and nine-coordinated in cotunnite-type phase (OII, space group Pnma). We demonstrate that the group IVa dioxides (TiO₂, ZrO₂, HfO₂) on compression at ambient temperature all follow the common path: rutile > -PbO₂-type > baddeleyite-type (MI) > orthorhombic OI (Pbca) structure > cotunnite-type (OII). Bulk modulus of OI and OII phases are high (318 GPa and 431 GPa) respectively, and the hardness of cryogenically quenched OII phase is 36-38 GPa.

Author

Phase Transformations; Anatase; Rutile; High Pressure; High Temperature Tests; Compression Tests

20030067054 Wester Tillyrie House, Kinross, UK

A Triple Complex of Low-Angle Oblique Impact Structures in the Midland Valley of Scotland

Hamill, B. J.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

A linear chain of three elliptical impact structures has been identified in the Midland Valley of Scotland. These structures appear to have been produced by fragments of a large asteroid which disintegrated on impact. The primary impact site was the Loch Leven basin (56deg 12' N, 3deg 23' W), which is an elongated structure (18 x 8 km) with a central ridge and lateral terraces. Field evidence suggests an end-Carboniferous date for this impact, similar to that of several known North American craters and suggesting that this was a global event which may have been implicated in the disappearance of the forests of Laurentia and Laurussia.

Author

Asteroids; Craters; Terraces (Landforms); Fragments

20030067058 Museum fuer Naturkunde, Berlin, Germany

Shock Effects at Inclined Material Interfaces - Numerical Simulations

Hertzsch, J.-M.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

A phenomenon in high velocity impacts which is still not completely understood is the occurrence of localized deformations, melt veins, melt dikes, and localised formation of high pressure phases in impact craters, namely close to interfaces of different lithologies. Furthermore, the micromechanical properties of the materials and their effects on the propagation of shock waves determine the macromechanical behaviour of rocks subject to meteorite impacts. In order to study these phenomena, laboratory experiments on samples composed of two different rocks and numerical simulations of comparable situations have been carried out for a small number of configurations. Under the conditions present in the experiments and in the simulations, the materials do not melt by shock heating alone. However, considerable shear takes place at the interface of different materials and leads to additional temperature increase. In anticipation of planned further laboratory experiments, and in order to examine the effect of the angle between shock wave plane and interface between different materials, computer simulations of shock waves passing inclined material interfaces have been performed, and some results are presented here. Special attention is given to shock induced temperature changes in the material.

Derived from text

Meteorite Collisions; Hypervelocity Impact; Hypervelocity; Shock Wave Propagation; Computerized Simulation; Numerical Analysis

20030067061 Auburn Univ., AL, USA

Possible Modes of Emplacement of Coarse Impactoclastic Ejecta (Breccia) from a Large Body Impact on Earth: Chicxulub Ejecta in Belize, Central America

King, D. T., Jr.; Petruny, L. W.; Pope, K. O.; Ocampo, A. C.; Third International Conference on Large Meteorite Impacts;

2003; 2 pp.; In English; See also 20030067008; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Albion impactoclastic breccia, also called the Albion diamictite bed, which crops out on Albion Island, Belize, and nearby areas in Quintana Roo, Mexico, is a very coarse, carbonate clast-rich unit that was formed by ballistic sedimentation and ejecta debris-flow processes in the aftermath of the large-body impact event approximately 325 km away at Chicxulub on the Yucatán Peninsula of Mexico.

Author

Breccia; Meteorite Craters; Carbonates; Rocks

20030067064 NASA Johnson Space Center, Houston, TX, USA

Impact Lithologies and Post-Impact Hydrothermal Alteration Exposed by the Chicxulub Scientific Drilling Project, Yaxcopoil, Mexico

Kring, David A.; Zurcher, Lukas; Horz, Friedrich; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008

Contract(s)/Grant(s): NSF EAR-01-26055; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Chicxulub Scientific Drilling Project recovered a continuous core from the Yaxcopoil-1 (YAX-1) borehole, which is approx.60-65 km from the center of the Chicxulub structure, approx.15 km beyond the limit of the estimated approx.50 km radius transient crater (excavation cavity), but within the rim of the estimated approx.90 km radius final crater. Approximately approx.100 m of melt-bearing impactites were recovered from a depth of 794 to 895 m, above approx.600 m of underlying megablocks of Cretaceous target sediments, before bottoming at 1511 m. Compared to lithologies at impact craters like the Ries, the YAX-1 impactite sequence is incredibly rich in impact melts of unusual textural variety and complexity. The impactite sequence has also been altered by hydrothermal activity that may have largely been produced by the impact event.

Author

Impact Melts; Boreholes; Cavities; Craters; Excavation; Lithology

20030067067 New Brunswick Univ., Fredericton, New Brunswick, Canada

The Nature of the Groundmass of Surficial Suevites from the Ries Impact Structure, Germany

Osinski, G. R.; Grieve, R. A. F.; Spray, J. G.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Hypervelocity impact events generate pressures and temperatures that can vaporize, melt, shock metamorphose, and/or deform a substantial volume of the target sequence. The transport and mixing of impact-metamorphosed rocks and minerals during the excavation and formation of impact craters produces a wide variety of distinctive impactites. Here, we present the results of a detailed field, optical, and analytical SEM study of surficial suevites from the Ries impact structure. Suevite has been generally defined as a polymict impact breccia with a clastic matrix containing fragments of impact glass and shocked mineral and lithic clasts. Our study focussed specifically on the little studied and poorly understood matrix of the surficial suevites. The results of our study reveal that the matrix is not clastic as previously thought, but contains a variety of impact melt phases.

Author

Meteorite Craters; Impact Melts; Metamorphic Rocks; Breccia

20030067075 City of Buenos Aires, Buenos Aires, Argentina

Estancia Los Mellizos: A Potential Impact Structure in Santa Cruz, Patagonia, Argentina, South America

Rocca, M. C. L.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Southern part of Argentina has a total surface of 786,112 square kilometers. It is composed of five Provinces: Neuquen, Rio Negro, Chubut, Santa Cruz and Tierra del Fuego. So far no impact sites has been reported in this wide zone. As a part of an on-going project to discover meteorite impacts, this area was investigated by the author through the examination of 76 color LANDSAT satellite images (1:250,000 - resolution = 250 meters) at the Instituto Geografico Militar (IGM) (=Military Geographic Institute) of Buenos Aires city. When a potential candidate was found a more detailed study of images was done. LANDSAT color images; scale 1:100,000 (IGM), and aerial photographs; scale 1: 60,000 (IGM), were then consulted. One promising site to be a complex impact structure was identified in Santa Cruz. The co-ordinates given are those

of the two corners of a rectangle enclosing the site: the upper left and the lower right points. That is the system used at IGM to obtain the data. Further evaluation of this site is in progress.

Derived from text

Argentina; South America; Structural Properties (Geology); Geological Surveys; Meteorite Collisions

20030067077 Astrobleme Exploration, Sainte-Foy, Quebec, Canada

Mass-Movement in Geological Strata of Some Astroblemes

Rondot, J.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The impact of large meteorites results in the displacement of two main rock types apart from the relatively undisplaced autochthonous target rocks. The first type consists of allochthonous rocks which, during the formation of a transient crater, are transformed and displaced from their original position, in part to great distances: deposits of breccia, suevite, impactite, etc. They lie on the crater floor and beyond. The second type are parautochthonous rocks which are composed of sedimentary or crystalline rock assemblages which have preserved their internal coherence, but are separated by faults containing a particular kind of breccia indicating a long period of relative movements, which are often contradictory. From a geological point of view, the relative positions of these rock assemblages with respect to their original position provides indications on their displacements during the readjustment which followed the excavation of the original crater.

Author

Meteorite Craters; Breccia; Impact; Sedimentary Rocks; Displacement

20030067078 Museum fuer Naturkunde, Berlin, Germany

Internal Shearing and Subsurface Erosion from the Chicxulub Ejecta Blanket (Albion Fm.), Quintana Roo, Mexico

Schoenian, F.; Kenkmann, T.; Stoeffler, D.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008

Contract(s)/Grant(s): DFG-GRK-503; Proj. A1; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Processes leading to far-reaching ejecta outflows and ejecta blanket fluidization on planetary bodies with atmospheres and/or volatiles in the target (i.e. Venus, Mars, and Earth) are poorly understood because of the lack of field control. The Chicxulub ejecta blanket has been considered as a favourable study object for examining these processes because of its preservation by rapid post impact burial on a shallow marine platform. Ejecta material considered as part of the continuous ejecta blanket from the Chicxulub crater have first been described from Albion Island, Northern Belize, at a distance of 4 crater radii (354 km) from the proposed impact center. In the Albion quarry the ejecta blanket is represented by a two-fold sequence of a basal spheroid bed, and the Albion diamictite, the ejecta blanket sensu stricto. The Albion diamictite has been interpreted as a product of a secondary flow after ejecta curtain collapse and has been compared to fluidized ejecta blankets on Mars and Venus. The flow has either been discussed of being a secondary turbulent/laminar debris flow or a turbulent atmospheric flow produced by drag-induced ring vortices (ring vortex model). It is considered that most of the Albion Formation is composed of primary ejecta from Chicxulub and ablated, polished and striated clasts are thought to represent high-altitude ballistic ejecta.

Author

Meteorite Craters; Ejecta; Earth Surface; Ocean Bottom

20030067079 Karlsruhe Univ., Germany

'Fingerprinting' Target Lithologies of the Chicxulub Crater in Ejecta from NE Mexico and Texas: Yucatan Subsurface Revisited

Schulte, Peter; Kontny, Agnes; Stinnesbeck, Wolfgang; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Microtektite- ('spherule'-) bearing proximal Chicxulub ejecta deposits from K-T sites in NE Mexico and Brazos, Texas, are a valuable tool to constrain original target lithologies at the Yucatán impact site, particular since the NE Gulf of Mexico region probably received ejecta from the northwestern, not yet drilled crater sector. In addition, petrological characteristics of the ejecta may allow detailing ejection and dispersion processes.

Author

Craters; Drilling; Ejecta; Tektites; Petrology

20030067081 New Brunswick Univ., Fredericton, New Brunswick, Canada

Chilling Evidence for the Bulk Composition of the Impact Melt Sheet at Sudbury: Evidence from Offset Dykes

Spray, John G.; Murphy, Alain J.; Shaw, Cliff S. J.; Tuchscherer, Martin G.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Determining the bulk composition of impact-generated melt sheets in impact structures presents a number of difficulties. For small (simple) structures, local splash melts may provide viable indicators. However, there is some debate as to whether melt ejecta represent bulk fused target compositions, or whether they represent specific layers, successfully revealed and removed during penetration and excavation. For ejecta, the latter scenario would appear more likely. For larger (complex) structures, and especially peak-ring and multi-ring basins, there is the likelihood of impact melt differentiation, such that the original bulk melt is not preserved. In these cases, the original impact melt composition can be determined by carefully reassembling individual layer compositions and thicknesses. In the case of the Sudbury impact structure of Ontario, Canada, estimates of the original bulk composition have been determined by several workers over the last century using the reassembly approach. An alternative and more direct method is afforded by the chilled margins of impact melt dykes that penetrate the footwall. Because of their limited dimensions and their juxtaposition with relatively cold country rock, such dykes can effectively isolate impact melt from subsequent differentiation and so retain their more primitive composition. This work concerns the use of chilled margins of certain Offset Dykes at Sudbury to constrain to bulk composition of the original impact melt. These compositions are used to model the evolution of the Sudbury igneous complex (SIC), Sublayer and related economic deposits.

Derived from text

Impact Melts; Rock Intrusions; Structural Properties (Geology); Structural Basins; Mineral Deposits

20030067084 Birmingham Univ., UK

A New Mid- to Late-Maastrichtian Impact in the Raton Basin 100m Below the K/T Boundary

Turner, P.; Sherlock, S. C.; Clarke, P.; Cornelius, C.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

We report a new impact from the Raton Basin, south central Colorado which is 100 m below the well-documented Raton K/T deposit layer in the Berwind Canyon (Figure 1). The Berwind Canyon impact deposit comprises a glass bomb bed, tsunamiite and reworked glass bomb bed. These are found within the Vermejo Formation which is stratigraphically below the Raton Formation that hosts the K/T deposit. Here we present stratigraphic and petrographic details of the Berwind Canyon impact deposit.

Derived from text

Cretaceous-Tertiary Boundary; Structural Basins; Stratigraphy; Petrography; Meteorite Collisions

20030067085 Calgary Univ., Alberta, Canada

Chicxulub Crater Structure Revealed by Three Dimensional Gravity Field Modelling

Hildebrand, A. R.; Millar, J. D.; Pilkington, M.; Lawton, D. C.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The structure of the Chicxulub crater has been actively investigated by potential field modeling, seismic reflection and refraction surveys, and drilling during the decade since its recognition as the crater responsible for mass extinction which terminated the Cretaceous Period. We have undertaken 3D modeling of the gravity field over the crater to refine our working structural model, and to compare our results with those of another 3D modeling effort. The 3D gravity model also establishes an interesting target for scientific drilling.

Author

Craters; Gravitational Fields; Three Dimensional Models; Seismology

20030067088 Physical Research Lab., Ahmedabad, India

Shocked Quartz at the Permian-Triassic Boundary (P/T) in Spiti Valley, Himalaya, India

Shukla, A. D.; Bhandari, N.; Shukla, P. N.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Permian-Triassic boundary (PTB, approx. 250 Ma) marks the transition of Paleozoic to Mesozoic. Several causative mechanisms involving terrestrial and extraterrestrial processes have been advocated to explain physical and chemical anomalies found at this horizon. Short duration biological crisis (less than 10 - 165ky), anomalous (3)He in fullerenes, planar deformation features in quartz and sharp delta (13)C excursion, anomalous delta (34)S etc suggest sudden and catastrophic nature of this event. In Spiti valley, the PTB is identified as a ferruginous band, sandwiched between Permian gray-black shale and Triassic limestone. Earlier studies carried out on the same sedimentary sequences confirmed that records of geochemical and geological events such as global anoxia, delta (13)C excursion (both in organic and inorganic), as observed in worldwide P/T sections are present here. Anomalous europium enrichment reported from the Lalung section favors an iridium-poor and europium-rich impactor. Recently we have also found nano-size iron oxyhydroxide phases similar to those observed at KTB and expected to originate in the impact vapour plume. Here we report the presence of quartz grains with planar deformation features found in a thin section in the ferruginous band from Attargoo (Lingti) section. In this section, the quartz grains are confined to two parallel bands (dark) embedded in phosphatic nodular groundmass (Ca & P). An enlarged backscatter image of a quartz grain is shown. The individual lamellae thickness varies between 3-6 m while the PDFs are less than 2-3 m thick, indicating a high degree (greater than 10Gpa) of shock pressure, usually encountered in impact events. Such features can not be related to Himalayan tectonism because there is no evidence of any metamorphism in the adjacent Permian shale as well as Triassic limestone horizons. Therefore, it is likely that these grains were incorporated in the ferruginous band as part of the ejecta after they were formed during an impact event. The presence of shocked quartz grains thus support a catastrophic event at the P/T boundary.

Author

Meteorite Collisions; Quartz; Grains; Deformation; Strata; Shock

20030067089 Oslo Univ., Norway

Mjolnir Marine Crater Resulting from Oblique Impact: Compelling Evidence

Tsikalas, F.; Faleide, J. I.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The 40-km-diameter Mjolnir crater is a well-established complex marine impact crater in the central Barents Sea. Both geophysical and geological data unequivocally substantiate a meteorite bolide impact at approx. 142 Ma into an epicontinental basin with 300-500 m paleo-water depth. It is well documented that the probability for near-vertical and grazing impacts is approximately zero, and that the most probable impact angle of a randomly incident projectile is 45 deg. Following the above estimates, the Mjolnir impact most probably derailed from vertical incidence. In this study, based on the established Mjolnir structure, morphology, and gravity and seismic velocity signatures we search for evidence revealing the impact direction and angle. Such parameters are vital for refining the geographic distribution of ejecta and tsunami-waves, and thus the possible impact-induced regional perturbations and environmental stress.

Author

Meteorite Craters; Meteorite Collisions; Ocean Bottom; Direction; Angles (Geometry)

20030067090 Academy of Sciences (USSR), Novosibirsk, USSR

Breccia Veins, Pseudotachylites and Fluidizite Dykes in Archean Gneiss Fragments from the Popigai Megabreccia

Vishnevsky, S. A.; Raitala, J.; Gibsher, N. A.; Palchik, N. A.; Ohman, T.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Some Archean gneiss fragments from the Popigai megabreccia exhibit traces of shock metamorphism up to stage II after, whereas other gneiss lumps are only fractured and locally brecciated. One of us (S.V.) observed fine-fragment breccia veins with stream-like masses of dark cryptograin matter in the lumps; one of the gneiss fragments contains several thin (3-10 cm) dykes filled with tuff-like glass-bearing material. Later it was found that the stream-like masses in some breccia veins are pseudotachylites (outcrop No. 479), and dykes with the tuff-like material are injections of impact fluidizites. A detailed description of the fine fragment breccia and impact fluidizites are presented.

Derived from text

Breccia; Fragments; Gneiss; Metamorphism (Geology); Precambrian Period; Veins (Petrology); Rock Intrusions

20030067092 Tasmania Univ., Hobart, Australia

Distribution and Abundance of Darwin Impact Glass

Howard, K. T.; Haines, P. W.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Since its first discovery in soils near Mt Darwin, western Tasmania, Australia, impact glass has been reported across an area of about 400 km² [1,2]. Across much of this area Darwin glass appears to be patchily distributed and its distribution is poorly defined. We have improved the constraints on the dimensions of the strewn field and estimated the abundance of glass. Stratigraphic setting of Darwin glass: Across the strewn field the glass is intimately associated with quartzite gravels. The gravels are residual deposits formed largely from the in situ weathering of quartz veins in country rocks. Transport of the quartz fragments, especially in flat areas has largely been vertical. Glasses recovered from these gravels show fine surface sculpting and delicate primary morphologies that further suggest both the glass and therefore the gravels have not undergone significant lateral movement or spent time entrained in fluvial transport. As residual deposits the nature of the glass bearing gravel horizons is strongly influenced by elevation and topography.

Author

Glass; Cratering; Mapping

20030067093 Academy of Sciences (USSR), Novosibirsk, USSR

Suevite-Tagamite Megamixtures: An Impact Formation on the Floor of the Popigai Suevite Strata

Vishnevsky, S. A.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Popigai explosion cloud deposits (the suevite strata) are well preserved in inner basin and annular trough of the crater and include several types of suevite formations. The Parchanai suevite formation, or PSF (the volume and nomenclature of Popigai impact formations is based upon our classification), occupies the lower part of the strata and contains a number (up to 50-70 % of the rock volume) of glass particles, mainly of lapilli-size. The rest of the rock is a matrix made up of mainly psammitic fragments of target lithologies, among which the clasts of the soft Mesozoic rocks dominate. Parchanai suevites came from the lower part of the explosion cloud and were the first to be deposited in a relatively hot state; they are well lithified and strongly altered. In the field, the PSF rocks are well distinguishable from any other suevites due to pumice strongly altered light-greenishyellow glass fragments. Syngenetic (i.e., originated during cratering) relations of the PSF with underlying bottom impact formations are the next: 1) in some places of the inner ring of the Archean gneisses the suevites either were emplaced directly on them, or served as a cementing matrix of the gneiss fragments; 2) in some other places of the ring and the crater margin the suevites are emplaced on the impact melt rocks-tagamites, or are included as small irregular bodies in the uppermost part of the tagamite sheet and megabreccia. Epigenetic (i.e., originated during post-impact modification of the crater) relations of the PSF with the bottom impact formations are the next: 1) the suevites are the wall rocks for numerous intrusions of the buried tagamite melt; 2) sheet-like and cover tagamite bodies in and on the suevites are known on the slopes of the inner ring and in some places of the crater; they originated as a result of gravity slumping and melt flow from the highlands.

Author

Impact Melts; Meteorite Craters; Gravitation; Fragments; Breccia; Strata

20030067100 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
Vaalbara and Tectonic Effects of a Mega Impact in the Early Archean 3470 Ma

Zegers, T. E.; Ocampo, A.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The oldest impact related layer recognized on Earth occur in greenstone sequences of the Kaapvaal (South Africa) and Pilbara (Australia) Craton, and have been dated at ca. 3470 Ma (Byerly et al., 2002). The simultaneous occurrence of impact layers now geographically widely separated have been taken to indicate that this was a worldwide phenomena, suggesting a very large impact: 10 to 100 times more massive than the Cretaceous-Tertiary event. However, the remarkable litho-stratigraphic and chronostratigraphic similarities between the Pilbara and Kaapvaal Craton have been noted previously for the period between 3.5 and 2.7 Ga (Cheney et al., 1988). Paleomagnetic data from two ultramafic complexes in the Pilbara and Kaapvaal Craton showed that at 2.87 Ga the two cratons could have been part of one larger supercontinent called Vaalbara. New Paleomagnetic results from the older greenstone sequences (3.5 to 3.2 Ga) in the Pilbara and Kaapvaal Craton will be presented. The constructed apparent polar wander path for the two cratons shows remarkable similarities and overlap to a large

extent. This suggests that the two cratons were joined for a considerable time during the Archean. Therefore, the coeval impact layers in the two cratons at 3.47 Ga do not necessarily suggest a worldwide phenomena on the present scale of separation of the two cratons. Although the impact 3470 Ma impact may have been more limited in size than previously thought, it is interesting to test if geological events described for the Pilbara and Kaapvaal Craton may represent the structural and magmatic results of an impact. The time series correlation between Lunar and Earth impact history and periods of high volcanic activity (Abbott and Isley, 2002) suggest that there is a causal relationship between crustal growth and meteorite impacts. The era between 3490 and 3400 Ma represents one of the best documented periods in which felsic continental crust was formed by intrusion and extrusion of TTG (tonalite, trondhjemite, granodiorite) melt. The stratigraphy consists almost entirely of mafic to ultramafic volcanic rocks and minor felsic (TTG) volcanic rocks. In this stratigraphy it may not be possible to distinguish impact melts from normal volcanic rocks. In both the Pilbara and Kaapvaal Craton extensional faults have been described, which were active at ca. 3470 Ma, during felsic volcanism and broadly coeval with the impact layers (Zegers et al., 1996, Nijman et al., 1998). These extensional structures have been interpreted as the result of caldera collapse (Nijman et al., 1998, Van Kranendonk et al, 2002) or as the result of delamination of lower crustal eclogite (Zegers and Van Keken, 2001). The question remains if there is any evidence in the geological record that this magmatic event could have been triggered Large Meteorite Impacts (2003) 4038.pdf by meteorite impacts. We will examine the possibility that these extensional fault patterns represent multi ring faults associated with a large impact. The early Archean greenstone terrains can be regarded as the closest analogue to Martian geology. Therefore the study of impact features in the Pilbara Craton may have implications for understanding impact features on Mars.

Author

Cratons; Meteorite Craters; Geochronology; Paleomagnetism; Tectonics

20030067101 NASA Johnson Space Center, Houston, TX, USA

Mesoscale Computational Investigation of Shocked Heterogeneous Materials with Application to Large Impact Craters

Crawford, D. A.; Barnouin-Jha, O. S.; Cintala, M. J.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color illustrations

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The propagation of shock waves through target materials is strongly influenced by the presence of small-scale structure, fractures, physical and chemical heterogeneities. Pre-existing fractures often create craters that appear square in outline (e.g. Meteor Crater). Reverberations behind the shock from the presence of physical heterogeneity have been proposed as a mechanism for transient weakening of target materials. Pre-existing fractures can also affect melt generation. In this study, we are attempting to bridge the gap in numerical modeling between the micro-scale and the continuum, the so-called meso-scale. To accomplish this, we are developing a methodology to be used in the shock physics hydrocode (CTH) using Monte-Carlo-type methods to investigate the shock properties of heterogeneous materials. By comparing the results of numerical experiments at the micro-scale with experimental results and by using statistical techniques to evaluate the performance of simple constitutive models, we hope to embed the effect of physical heterogeneity into the field variables (pressure, stress, density, velocity) allowing us to directly imprint the effects of micro-scale heterogeneity at the continuum level without incurring high computational cost.

Derived from text

Heterogeneity; Mesoscale Phenomena; Meteorite Craters; Shock Wave Propagation; Mathematical Models; Structural Properties (Geology)

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New Data on the Late Pliocene Eltanin Impact into the Deep Southern Ocean

Gersonde, Rainer; Kyte, Frank T.; Frederichs, T.; Bleil, U.; Kuhn, Gerhard; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The late Pliocene impact of the Eltanin asteroid is the only known asteroid impact in a deep-ocean (approx. 5 km) basin. This was first discovered in 1981 as an Ir anomaly in sediment cores collected by the USNS Eltanin in 1965[1]. The expeditions ANT-XII/4 (1995) and ANT-XVIII/5a (2001) of the RV Polarstern collected extensive bathymetric and seismic data sets as well as sediment cores from an area in the Bellingshausen Sea (eastern Pacific Southern Ocean) that allow the first comprehensive geoscientific documentation of an asteroid impact into a deep ocean (approx. 5 km) basin, named the Eltanin impact[2-5]. Impact deposits have now been recovered from a total of more than 20 sediment cores (including up to 17 cores from the 2001 expedition) collected in an area covering about 80,000 sq km. Sediment texture analyses and studies of sediment

composition including grain size and microfossil distribution reveal the pattern of impact-related sediment disturbance and the sedimentary processes immediately following the impact event. The pattern is complicated by the Freeden Seamounts (approx. 57.5° S, 90.5° W; we previously called these the San Martin Seamounts, but they were officially named Freeden in 1999), a large topographic elevation that rises up to 2700 m above the surrounding abyssal plain in the area affected by the Eltanin impact. The impact ripped up sediments as old as Eocene and probably Paleocene that have been redeposited in a chaotic assemblage. This is followed by a sequence sedimented from a turbulent flow at the sea floor, overprinted by fall-out of airborne meteoritic ejecta that settled through the water column. Grain size distribution of reworked sediments and ejecta reveals the timing and interaction of the different sedimentary processes.

Author

Asteroids; Impact; Sediments; Bathymeters; Seamounts

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Mass Transfer in Large Bolide Impacts: Geochemical Evidence from the Sudbury Structure

Mungall, J. E.; Hanley, J. J.; Ames, D. E.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The redistribution of matter in the lithosphere resulting from large bolide impacts affected the development of the early crust and upper mantle of the Earth and other terrestrial planets. Here we present rock composition data from the Sudbury impact structure representing magmatic liquids quenched shortly after the time of impact in environments spanning a stratigraphic column several kilometers high. Shock-melted lower crustal material has been elevated to the surface of the Earth to form a melt-sheet now preserved as the Sudbury Igneous Complex, effecting a regional overturn of the gross compositional stratification of the continental crust. Impact melt breccia from the lower crust has been injected along dikes and faults for distances of tens of kilometers throughout the brecciated upper crust. Fallback deposits of the Onaping Formation have compositions similar to that of the underlying melt-sheet but are zoned upward to reflect increasing contributions both from the original surficial sedimentary strata and from the impactor. Our work has implications for the crustal-scale redistribution of matter during large impact events, which controlled the stability and longevity of the crust during the Hadean Eon. The retention of impactor and supracrustal material in the uppermost portion of the impact-related stratigraphy is consistent with their having been ejected upward by the explosion of the impactor and target rocks after the impactor had implanted itself several km into the target crust. It thus appears that the impacting body did not remain within the crust, but was redeposited as a veneer at the Earth's surface mixed into the uppermost target rocks. Below this veneer, molten rock from the lower crust or mantle was elevated to the level of the upper crust, overlying the former rocks of the upper crust and effecting a major compositional overturn in the lithosphere. Offset dikes and Sudbury breccias record a process of injection of melted or otherwise disaggregated lower crustal material for distances of several tens of km laterally and upward from the zone of deep crustal melting into their present positions structurally beneath and adjacent to the Sudbury Igneous Complex. Intense meteorite bombardment might have repeatedly overturned the lithosphere, hindering the stabilization of continental crust until the normal run of impact melting events was too shallow to reach significantly below the base of the crust.

Author

Breccia; Geochemistry; Craters; Impact Melts; Earth Crust; Meteorites

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The Features of the Popigai: A Guiding Key for Large-Scale Impact Cratering Phenomena

Vishnevsky, S. A.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy; Available on CD-ROM as part of the entire parent document

The simple model of cratering is well established, and typical features of the simple craters (shape, rim, overturned flap, ejecta deposits, etc.) are studied in details. However, the theory of impact cratering cannot explain some features of large complex craters. For example, in spite of the numerous investigations, an origin of ring and central uplifts is still a matter of debates. Some other features of the craters are less debatable but not less important; their origin is also an open question. One of the ways to have a progress here might be based upon the field investigations and attempts to explain the debatable features. In this connection, some geological observations on the Popigai astrobleme (PA) and their interpretations may be of definite interest. Following to its size (100 km), young age (approx. 35 Ma), well preservation and good exposure, as well as to plenty of impact formations and diversity of target lithologies, the PA is a unique test site for the theory of large-scale cratering. Some key geologic features of the PA are presented below. Their description is based upon our nomenclature of the PA impact formations.

Author

Meteorite Craters; Cratering; Earth Surface; Structural Properties (Geology)

20030067108 Academy of Sciences (USSR), Moscow, USSR

Chemical Differentiation of Impact-produced Melt Droplets: Experiments and Observation

Gerasimov, M. V.; Yakovlev, O. I.; Dikov, Y. P.; Wlotzka, F.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color illustrations

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The main problem of the relation of ejected melted spherules and target rocks in impact structures is the unknown degree of their differentiation during the high-temperature stage. An investigation of trends of chemical differentiation of melted droplets during impact simulated processes can give a certain evidence for correlation between melt and target rocks in impact sites. Here we present experimental data on impact-simulated vaporization of obsidian that helps to reveal vaporization signatures in impact glasses formed from acidic and intermediate composition targets. A certain problem for the relating of melt spherules and target rocks is the mixing of target rocks and projectile material. The formed spherules can represent a continuous row of mixed compositions which is modified by volatilization of elements during high temperature processing.

Author

Impact Melts; Spherules; Drops (Liquids); High Temperature; Rocks

20030067112 Karpinsky Geological Research Inst., Saint Petersburg, USSR

Sulfide Mineralization in the 100-km Popigai Impact Structure, Russia

Naumov, M. V.; Lyakhnitskaya, V. D.; Yakovleva, O. A.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The presence of the world class Ni-Cu-PGE sulfide ores in the Sudbury impact structure has driven efforts to study the distribution of sulfides in other large impact craters. In this aspect, the 100-km Popigai impact structure (Northern Siberia, Russia) is of particular interest due to the occurrence of a wealth of impact melt rocks (approximately 3000 cubic kilometers); this amount is the largest for terrestrial craters except the Sudbury. The Popigai crater originated 35.7 Ma ago in twolayered target, which is composed of Archean and Lower Proterozoic crystalline rocks overlain by 1.5-km sequence of Upper Proterozoic, Paleozoic, and Mesozoic sediments. The crater fill consists of impact melt rock (massive, tagamite, and fragmental, suevite) and lithic breccia up to 2 km of total thickness. Some lense-like bodies of high-temperature (HT) and low temperature (LT) varieties can be distinguished within thick tagamite sheets. In this study, we explored spatial range and composition of the sulfide mineralization across the whole area of the Popigai crater, as well as in vertical sections through thick impact rock sequences. Although the sulfides are present in all impact lithologies, scattered dissemination or thin veins alone were found. Sulfides and associated minerals were studied using optical microscopy, X-ray diffractometry, electron microprobe analysis; some atomic emission spectroscopy and sulfur isotope measurements of sulfide separates were also carried out. Besides the concentrations of both major and trace elements in the impact melt rocks and target rock samples were measured; major elements were determined by XRF and trace elements by ICP-MS.

Derived from text

Meteorite Craters; Minerals; Russian Federation; Geology; Sulfides; Structural Properties (Geology); Geochemistry

20030067115 Helsinki Univ., Helsinki, Finland

The Suvasvesi South Structure, Central Finland: Further Evidences of Impact

Pesonen, L. J.; Donadini, F.; Salminen, J.; Lehtinen, M.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Suvasvesi South structure is located in Central East Finland (62 41 N, 28 11 E) and correlates with the Haapaselk open lake, the southern of the two circular Suvasvesi lakes. The target rock consists mainly of Proterozoic mica schists and migmatites in its easternmost part and granitoids in the western part. Suvasvesi S was first perceived in satellite images, and might form a crater doublet with the Suvasvesi N impact structure. We have previously presented evidences, such as presence of fractured target rocks and shatter-cone boulders on the eastern shore of Haapaselk, which suggest that the Suvasvesi S is also an impact structure. During the summer 2002 we carried out a new field survey in the area. The new bathymetric and geophysical data, coupled with thin section studies of the discovered melt boulders confirm that the Suvasvesi S is a new impact structure in Finland.

Author

Structural Basins; Meteorite Craters; Geological Surveys; Impact Melts; Shatter Cones

20030067119 Geological Survey, Reston, VA, USA

Recent Research in the Chesapeake Bay Impact Crater, USA, Part 1, Structure of the Western Annular Trough and Interpretation of Multiple Collapse Structures

Powars, D. S.; Gohn, G. S.; Catchings, R. D.; Horton, J. W., Jr.; Edwards, L. E.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The buried late Eocene Chesapeake Bay impact structure is a complex crater formed in a multi-layered, marine target. The target consisted of a neritic water column, 400 to >750 m of lower Tertiary and Cretaceous sediments, and underlying crystalline rocks. The 85-km-wide crater has a subquadrate, approx. 38-km-wide inner basin that is surrounded by an approx. 24-km-wide, flat-floored annular trough. The annular trough's outer margin has a slumped terrace zone surrounded by a approx. 35-km-wide outer fracture zone. New insights into the stratigraphic and structural configuration of the annular trough come from correlation of four deep coreholes and two corehole velocity logs with marine seismic-reflection surveys and a high-resolution, land-based, reflection survey (CDP spacing of 2.5m). The high-resolution survey is adjacent to two of the coreholes and provides sufficient resolution to delineate small structures.

Author

Meteorite Craters; Ocean Bottom; Structural Basins; Stratigraphy; Collapse; Sedimentary Rocks

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Origin and Emplacement of the Impact Formations at Chicxulub, Mexico, with Special Emphasis on the Yax-1 Deep Drilling

Stoeffler, D.; Hecht, L.; Kenkmann, T.; Schmitt, R. T.; Salge, T.; Tagle, R.; Weseler, S.; Wittmann, A.; Ivanoc, B. A.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The ICDP drilling Yaxcopoil-1, located in the annular ring trough of the 190 km Chicxulub peak ring impact basin, exposes some 715 m of impact-related lithologies below 795 m of post-impact Tertiary sediments [1]. We use 2D numerical modeling of the impact event to reproduce the crater growth and collapse and main ejecta mass deposition at the point where Yax-1 is located.

Author

Craters; Ejecta; Lithology

43

EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis of remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photography. For related instrumentation see *35 Instrumentation and Photography*.

20030066433 NASA Marshall Space Flight Center, Huntsville, AL, USA

Future Applications of Remote Sensing to Archeological Research

Sever, Thomas L.; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Archeology was one of the first disciplines to use aerial photography in its investigations at the turn of the 20th century. However, the low resolution of satellite technology that became available in the 1970 s limited their application to regional studies. That has recently changed. The arrival of the high resolution, multi-spectral capabilities of the IKONOS and QUICKBIRD satellites and the scheduled launch of new satellites in the next few years provides an unlimited horizon for future archeological research. In addition, affordable aerial and ground-based remote sensing instrumentation are providing archeologists with information that is not available through traditional methodologies. Although many archeologists are not yet comfortable with remote sensing technology a new generation has embraced it and is accumulating a wealth of new evidence. They have discovered that through the use of remote sensing it is possible to gather information without disturbing the site and that those cultural resources can be monitored and protected for the future.

Author

Remote Sensing; Archaeology; Aerial Photography; High Resolution

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Yaxcopoil-1 and the Chicxulub Impact

Stinnesbeck, W.; Keller, G.; Adatte, T.; Harting, M.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color illustrations

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We examined the lithology, stratigraphy and mineralogy of the CSDP well Yaxcopoil-1, which was drilled on the southern inner flank of the Chicxulub impact crater, approximately 60 km from its center [1]. Between 775m and 1511m depth we identified 10 major bio- and lithostratigraphic units. The lower part of the core up to 894m contains a sequence of limestones, dolomites and anhydrites of late Cretaceous ages. Lithologies, microfacies and fossil contents indicate deposition occurred in various carbonate platform environments (e.g., sabkha, lagoons). In addition, a marly limestone between 1511 and 1495m contains abundant planktic foraminifera that reflect an open marine shelf environment of latest Cenomanian age (top R. cushmani Zone).

Author

Craters; Breccia; Lithology; Mineralogy

20030067205 Physics and Electronics Lab. TNO, The Hague

Measurements and Modeling of Soil Water Distribution Around Landmines in Natural Soil

Lensen, Henk A.; Schwering, Piet B. W.; Marin, Garciela R.; Hendrickx, Jan M. H.; Jan. 2001; 11 pp.; In English

Report No.(s): AD-A413505; No Copyright; Avail: CASI; [A03](#), Hardcopy

Soil water content, dielectric constant, electrical conductivity, thermal conductivity and heat capacity affect the performance of many sensors (e.g. GPR, TIR) and therefore the detection of landmines. The most important of these is water content since it directly influences the other properties. We measure soil water distribution around an antitank and an antipersonnel mine buried in a sand soil under varying moisture levels. After a period of two days with 38 mm precipitation the water content below the AP-mine increased from 0.07 to 0.12 M3/M3. The water content above and below the AT-mine increased from 0.09 to 0.17 M3/M3 and 0.09 to 0.13 M3/M3, respectively. Below the AT-mine it was 0.02 to 0.04 M3/M3 dryer than above the mine. The dielectric constant of the soil was estimated from the soil water content. After a dry period of two weeks the dielectric contrast between the AT-mine was approximately 2 F/m. After a period of 38 mm precipitation the contrast between AT-mine and background increased to 6 F/m. Differences in soil water distribution around the AT-mine caused a maximum dielectric contrast 4.5 F/m between background and mine. This effect was less apparent around the AP-mine (1.3 F/m. Differences in measured and simulated soil water distribution around an AT-mine urge for further investigation.

DTIC

Soils; Mines (Ordnance); Water; Soil Moisture

20030067206 Agricultural Research Service, Riverside, CA

Modeling Transient Temperature Distributions Around Landmines in Homogenous Bare Soils

Simunek, J.; Hendrickx, J. M. H.; Borchers, B.; Jan. 2001; 11 pp.; In English

Report No.(s): AD-A413506; No Copyright; Avail: CASI; [A03](#), Hardcopy

The objective of this study is to expand our exploration of the effects of the soil environment on landmine detection by investigating the influence of soil texture and water content on surface soil temperatures above antitank mines buried at 15 cm depth and away from it. Temperature distributions in July were calculated in six soil textures (sandy loam, loam, silt, silt loam, sandy clay loam, and clay loam) for the climatic conditions of Kuwait and Sarajevo. We evaluated the temperature distributions in typical dry and wet soil profiles. The simulated temperature differences varied from .22 - .63 degree C in Kuwait to .16 - .37 in Sarajevo. Temperature differences were -with one exception- larger in the wet than in the dry soils which suggests that soil watering may help improve thermal signatures. A major finding of this study is that the thermal signature of an anti tank mine strongly depends on the complex interaction between soil texture, water content, and geographical location. It is very difficult to predict the exact time or even the approximate hour of the appearance or non-appearance of a thermal signature. Therefore, this modeling study indicates that the use of a thermal sensor in a real mine field for instantaneous mine detection carries a high risk. On the other hand if a given area can be monitored constantly with a thermal sensor for twelve hours or longer the thermal signature will be detected if the signal to noise ratio of the mine environment allows so. Field experiments are needed to validate the results of this modeling study.

DTIC

Soils; Surface Temperature; Mine Detectors; Moisture Content; Environmental Tests

20030067211 Arizona Univ., Tucson, AZ

Multisensor Approach to Mapping of 2D and 3D Geologic Features from Remotely Sensed Imagery

Baker, Victor R.; Aug. 14, 2001; 7 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0426

Report No.(s): AD-A413544; P-39054-GS; ARO-39054.1-EV; No Copyright; Avail: CASI; [A02](#), Hardcopy

The specific aims of this study are to develop and validate computational methodologies to characterize regional geomorphology at multiple scales using remote sensing data. A University of Texas portion of the study focuses on the remote sensing computations and our portion focuses on paleohydrological and geomorphological interpretations. In the University of Arizona portion of the project we found that the quantitative remote sensing imagery provided key data on gradients and patterns of past floods (paleofloods). We were able to use these data in quantifying the paleohydraulic parameters of mm, high-energy floods, particularly in the arid landscapes of Australia and Arizona.

DTIC

Thematic Mapping; Geomorphology; Structural Properties (Geology)

20030067403 New Mexico Inst. of Mining and Technology, Socorro, NM

Spatial Variability of Dielectric Properties in Field Soils

Hendrickx, J. M.; Borchers, B.; Woollayer, J.; Dekker, L. W.; Ritsema, C.; Jan. 2001; 11 pp.; In English

Report No.(s): AD-A413436; ARO-38830-EL-LMD; No Copyright; Avail: CASI; [A03](#), Hardcopy

Most mine detection sensors are affected by soil properties such as water content, temperature, electrical conductivity, and dielectric constant. The most important of these is water content since it directly influences the three other properties. The variability of these properties may be such that either potential land mine signatures are overshadowed or false alarms result. In this paper we present the results of field measurements in the Netherlands, Panama, and New Mexico on spatial variability of soil water content. We also discuss how the variability of soil water content affects the soils electrical conductivity and dielectric constant and the resulting response of a ground penetrating radar system.

DTIC

Mine Detectors; Dielectric Properties; Soils; Ground Penetrating Radar; Moisture Content

20030067594 Colorado Univ., CO, USA, New Mexico Univ., NM, USA

[Development and Use of Hidrosig]

Gupta, Vijay K.; Milne, Bruce T.; [2003]; 5 pp.; In English

Contract(s)/Grant(s): NAG5-10954; No Copyright; Avail: CASI; [A01](#), Hardcopy

The NASA portion of this joint NSF-NASA grant consists of objective 2 and a part of objective 3. A major effort was made on objective 2, and it consisted of developing a numerical GIS environment called Hidrosig. This major research tool is being developed by the University of Colorado for conducting river-network-based scaling analyses of coupled water-energy-landform-vegetation interactions including water and energy balances, and floods and droughts, at multiple space-time scales. Objective 2: To analyze the relevant remotely sensed products from satellites, radars and ground measurements to compute the transported water mass for each complete Strahler stream using an 'assimilated water balance equation' at daily and other appropriate time scales. This objective requires analysis of concurrent data sets for Precipitation (PPT), Evapotranspiration (ET) and stream flows (Q) on river networks. To solve this major problem, our decision was to develop Hidrosig, a new Open-Source GIS software. A research group in Colombia, South America, developed the first version of Hidrosig, and Ricardo Mantilla was part of this effort as an undergraduate student before joining the graduate program at the University of Colorado in 2001. Hidrosig automatically extracts river networks from large DEMs and creates a 'link-based' data structure, which is required to conduct a variety of analyses under objective 2. It is programmed in Java, which is a multi-platform programming language freely distributed by SUN under a GPL license. Some existent commercial tools like Arc-Info, RiverTools and others are not suitable for our purpose for two reasons. First, the source code is not available that is needed to build on the network data structure. Second, these tools use different programming languages that are not most versatile for our purposes. For example, RiverTools uses an IDL platform that is not very efficient for organizing diverse data sets on river networks. Hidrosig establishes a clear data organization framework that allows a simultaneous analysis of spatial fields along river network structures involving Horton-Strahler framework. Software tools for network extraction from DEMs and network-based analysis of geomorphologic and topologic variables were developed during the first year and a part of second year.

Author

Remote Sensing; Water Balance; Evapotranspiration

20030067646

Evaluation of the IBM T221 16 x 10 Aspect Ratio, 22.2-Inch Diagonal 3840 x 2400 Pixel LCD Color Monitor

May 8, 2002; 94 pp.; In English; Original contains color illustrations

Report No.(s): AD-A414833; NIDL-750811201-130; No Copyright; Avail: CASI; A05, Hardcopy

NIDL evaluated a 22-inch diagonal 0.12 mm pixel pitch IBM 3840 x 2400 pixels (9-megapixels) color digitally-addressed LCD monitor Model T221 purchased for delivery to NIMA. IBM has recently reduced the purchase price to \$8,399. We find that images and Briggs patterns at 2X (1920 x 1200 pixels) look excellent. The monitor exceeds the NIMA IEC Working Group specifications for monoscopic mode color applications. Accordingly NIDL gives it an A' rating and thereby certifies the IBM 9-megapixel monitor for color monoscopic IEC workstations. LCDs generally cannot refresh fast enough to do stereo at the 120 Hz vertical refresh rate needed for StereoGraphics ZScreen or CrystalEyes based stereo. We found that the ability to roam quickly is a function of the computer the display graphics card the image manipulation software and the display itself. For the T221 using a low-end version of Remote View the smoothest roam of three graphics cards tested was observed using a Radeon 8500 single-DVI digital display graphics card at 1920 x 1200 pixels at 41Hz. We achieved 100 to 300 pixels per second.

DTIC

Optical Properties; Monitors; Computer Graphics

44

ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power*; *20 Spacecraft Propulsion and Power*; and *28 Propellants and Fuels*.

20030066244 Naval Research Lab., Washington, DC, USA

Excel Computational Design Tool: Multifunctional Structure-Battery Materials

Thomas, James P.; Qidwai, M. A.; April 17, 2003; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-00-WX-2-1219

Report No.(s): AD-A413821; NRL/MR/6350-O3-8677; No Copyright; Avail: CASI; A03, Hardcopy

This report describes a computational Structure-Battery Design Tool (SBDT) developed at the Naval Research Laboratory for analyzing the mechanical and electrical performance of multifunctional structure-battery materials configured in prismatic beam geometries. SBDT is implemented in Excel spreadsheet form and is capable of analyzing composite designs with several cross-section geometries including circular-annular rectangular-annular, arbitrary-box, and multilayers. Instructions for using the SBDT and an overview of the calculations performed therein are included below.

DTIC

Electric Batteries; Electrical Properties; Performance Tests

20030066373 NASA Marshall Space Flight Center, Huntsville, AL, USA

Structural Model for the Flip-Flop Action in Thiamin Pyrophosphate-Dependent Human Pyruvate Dehydrogenase

Ciszak, Ewa; Dominiak, Paulina; [2003]; 1 pp.; In English; Gordon Research Conference, 13-18 Jul. 2003, Meriden, NH, USA; Copyright; Avail: Other Sources; Abstract Only

The derivative of vitamin B1 thiamin pyrophosphate (TPP) is a cofactor of enzymes performing catalysis in pathways of energy production, including (i) decarboxylation of alpha-keto acids followed by (ii) transketolation. These enzymes have shown a common mechanism of TPP activation by imposing an active V-conformation of this coenzyme that brings the N4 atom of the aminopyrimidine ring to the distance required for the intramolecular C-H N hydrogen-bonding with the C2- atom of the thiazolium ring. The reactive C2 atom of TPP is the nucleophile that attacks the carbonyl carbon of different substrates used by the TPP-dependent enzymes. The structure of the heterotetrameric human pyruvate dehydrogenase (E1p) recently determined in our laboratory (1) revealed the association pattern of the subunits and the specifics of two chemically equivalent cofactor binding sites. Dynamic nonequivalence of these two cofactor sites directs the flip-flop action of this enzyme, depending upon which two active sites effect each other (2). The crystal structure derived from the holo-form of E1p provided the basis for the model of the flip-flop action of E1p in which different steps of the catalytic reaction are performed in each of the two cofactor sites at any given moment, where these steps are governed by the concerted shuttle-like motion of the

subunits. It is further proposed that balancing a hydrogen-bond network and related cofactor geometry determine the continuity of catalytic events.

Author

Hydrogen Bonds; Decarboxylation; Pyruvates; Carbonyl Compounds; Chemical Bonds; Crystal Structure

20030067259 Illinois Univ. at Urbana-Champaign, Urbana, IL

Ultrafast Spectroscopy of Energetic Materials and Energetic Mechanical Processes

Dlott, Dana D.; Feb. 26, 2001; 12 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0049

Report No.(s): AD-A413661; AFRL-SR-AR-TR-03-0091; No Copyright; Avail: CASI; [A03](#), Hardcopy

The goal of this project is to develop a fundamental understanding of fast mechanical processes at a molecular level. It is believed that this fundamental research will lead to a clearer understanding of energetic mechanical processes relevant to the AFOSR mission and in the broader world as well. These include the following: (1) impact initiation of energetic materials; (2) mechanical failure by debonding, cracking, or spallation; (3) lubrication dynamics of high speed parts; and (4) fast combustion of metal particle/oxidizer composites. These processes are induced by laser-generated shock waves, laser heating, or specific vibrational pumping with tunable femtosecond mid-infrared pulses. These perturbations are followed by fast infrared or Raman probing to study the vibrational transitions of mechanically perturbed molecules or materials. Mid-infrared absorption creates a highly nonequilibrium vibrational population whose relaxation is relevant to all highly energetic chemical processes. Shock waves create high pressure, large amplitude structural perturbations, high temperatures, and large strain rates. Using ultrafast shock compression, the authors could initiate energetic chemistry, cracking, debonding and spallation, and produce stress on liquids at solid interfaces that mimics the stress felt in high speed engines. Laser flash heating is used to heat metal nanoparticles embedded in oxidizing matrices. The hot metal particles can then undergo fast energetic oxidation chemistries.

DTIC

Shock Waves; Nanoparticles; Molecules

20030067296 Mississippi State Univ., Mississippi State, MS

Design and Construction of a Ground-Source Heat Engine

Stevens, James W.; Jan. 24, 2002; 5 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0307

Report No.(s): AD-A414544; ARO-38965.3-CH; No Copyright; Avail: CASI; [A01](#), Hardcopy

The purpose of this project was to design, construct and test a ground source heat engine that would operate on the temperature difference between the air and the ground to produce a small amount of electrical power. During the design phase, expressions for an optimally matched heat exchanger and thermoelectric module configuration were derived. A prototype was constructed according to the design procedure developed in the first phase of the project using an off-the-shelf thermoelectric module. The prototype was instrumented and tested over an extended period. It was found that the relationship between the temperature drop across the thermoelectric module and the total air-ground temperature difference varied with the time of day. Part of this variation was attributed to direct solar insolation in the afternoon. A rough estimate of the potential generation with optimally matched custom components indicated an increase in output by a factor of nineteen. Most of the electricity generation (780%) occurred between the hours of noon and 4pm during the period of this test April-May at 33 deg N latitude.

DTIC

Thermoelectric Power Generation; Surface Temperature; Heat Engines; Temperature Gradients

20030067438 Technische Univ., Delft

Investigation of the Rotor-Tower Instability of the KEWT Wind Turbine

Pavel, M. D.; Nov. 1999; 51 pp.; In English

Report No.(s): PB2003-104787; M-879; Copyright; Avail: National Technical Information Service (NTIS)

This report reassesses the dynamic instabilities of the KEWT ('Kosten Effective Wind Turbin') wind turbine prototype. The KEWT wind turbine was a two bladed wind turbine in the 1980s. During tests, violent vibrations were observed as the rotor angular velocity. This report further investigates the KEWT instabilities, concentrating on the case of tower second bending-blade edgewise instability. It is demonstrated that the 'advancing lag mode' is responsible for the coupling between the lead-lag and the second tower-bending mode. The generator supplies energy to the control system in order to keep the rotor rpm constant. The new contribution in this report concerns the demonstration that the lead-lag instability is in the advancing

mode. To prove this, a method is used which can predict the couplings between the uncoupled rotor and tower dynamics. The method consists in essence of representing in the complex plane the uncoupled poles of different modes and defines critical regions in the complex plane.

NTIS

Wind Turbines; Stability; Towers

45

ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

20030066255

Kodiak Launch Complex, Alaska 2002 Environmental Monitoring Studies April QRLV-2 Launch

Cuccarese, Sal V.; Bogan, Daniel L.; Hensel, Richard J.; Kelly, Michael D.; Kennish, John M.; Jul. 2002; 33 pp.; In English Report No.(s): AD-A414159; No Copyright; Avail: CASI; [A03](#), Hardcopy

This document provides the results of environmental monitoring studies done in support of the 24 April 2002 launch of the Quick Reaction Launch Vehicle (QRLV-2) from the Kodiak Launch Complex (KLC), Kodiak Island, Alaska. The University of Alaska Anchorage's Environment and Natural Resources Institute (ENRI) conducted the studies under contract to the Alaska Aerospace Development Corporation (AADC), which is a state-owned entity. An Environmental Monitoring Plan (EMP) was developed by ENRI for five environmental monitoring tasks: Steller sea lion surveys, rocket motor noise measurements, bald eagle nest monitoring, Steller's eider surveys, and environmental quality monitoring. The EMP had a design life of five launches, with the last occurring in November 2001. AADC subsequently requested that ENRI develop an integrated series of environmental studies for KLC launches in 2002. Four prelaunch and three postlaunch bird surveys were successfully conducted 20-26 April. ENRI conducted point-count surveys at 11 locations and did a complete survey of the lagoon immediately northeast of the launch pad. All birds seen within a 500-meter radius of each point-count station over a 15-minute period were identified to species and tallied. Steller's eiders were only observed in the study area during the first survey, therefore no conclusions regarding the effects of rocket motor noise on this species can be drawn. Pre- and postlaunch harlequin duck numbers were similar, indicating the QRLV-2 launch did not adversely affect the species. The rocket launch also did not produce noticeable effects on the bald eagles that were nesting in the area. This Environmental Assessment also includes the results of surface water chemistry tests to detect any changes in aquatic chemistry, collection of aquatic macroinvertebrates as biological indicators of change, and surveys of epiphytic macrolichens to monitor vegetation. (14 tables, 5 figures, 15 refs.)

DTIC

Water Quality; Invertebrates; Noise Pollution; Rocket Launching; Rocket Exhaust; Lichens; Environmental Monitoring; Environmental Quality

20030066275 General Accounting Office, Washington, DC

Climate Change: Information on Three Air Pollutants' Climate Effects and Emissions Trends

Apr. 2003; In English

Report No.(s): PB2003-105922; GAO-03-25; No Copyright; Avail: National Technical Information Service (NTIS)

Solar radiation is absorbed by the earth and is subsequently reemitted. The buildup of carbon dioxide and certain other gases in the earth's atmosphere traps some of that radiation. This is known as the greenhouse effect and is believed to contribute to a warming of the earth's climate. Concerns are growing that, in addition to carbon dioxide and other conventional greenhouse gases, certain air pollutants may affect the climate. GAO was asked to examine (1) the extent of agreement among scientists regarding the effect on the climate of three air pollutants- black carbon (soot), ground-level ozone, and sulfate aerosols-and (2) seven countries' efforts to control these pollutants, trends in these substances in these countries over the past 2 decades, and estimates for the next decade. GAO was also asked to summarize the relationship between economic growth and environmental pollution. The seven countries include four that are economically developed- Germany, Japan, the UK, and the USA- and three that are developing- China, India, and Mexico. These countries were chosen because they have large economies with a high potential to emit these pollutants.

NTIS

Climate Change; Air Pollution; Greenhouse Effect

20030067320 Wisconsin Univ-Madison Dept. Of Chemistry, Madison, WI, USA

Interim Proposal for Molecular Beam Studies of Surfactants in Sulfuric Acid Aerosols: Comparisons Between Hydrocarbon and Fluorocarbon Alcohols

Nathanson, Gilbert M.; May 2003; 6 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0290; Proj-2303

Report No.(s): AD-A414462; AFRL-SR-AR-TR-03-179; No Copyright; Avail: CASI; [A02](#), Hardcopy

Heterogeneous reactions of gas phase molecules with aqueous sulfuric acid aerosols play a significant role in the destruction of ozone in the stratosphere. These processes include the acid-catalyzed reactions of HCl and HBr with ClONO₂ (BrONO₂) and HOCl (HOBr) to generate photoactive halogen molecules, particularly in colder regions of the stratosphere where they are more soluble in the water-rich aerosols. Our objective is to determine the mechanisms and rate-limiting steps of reactions of these atmospheric gases with these supercooled sulfuric acid droplets. By employing molecular beam scattering techniques, we probe the nature of the initial gas-sulfuric acid collision and the immediate fate of HCl and HBr molecules trapped at the acid's surface as they either desorb into the gas phase or react in the interfacial or bulk regions of the aerosol. In this interim grant period, we have explored the ability of organic molecules dissolved in sulfuric acid to form surface films that impede gas uptake and thereby reduce the rates of heterogeneous reactions in the acid. These surface-active organic molecules are found naturally in the upper troposphere and tropopause and may be produced in the exhaust of jet aircraft. We have so far investigated the entry of trifluoroethanol and HCl gas molecules into bare sulfuric acid and acid coated with butanol, dodecanol, and hexadecanol. These hydrocarbon surfactants have kept us busy, and we have not yet compared them with fluorocarbon ones.

DTIC

Aerosols; Atmospheric Chemistry; Sulfuric Acid; Ozone Depletion; Molecular Beams; Hydrocarbons; Alcohols

20030067361 Department of Energy, Richland, WA, USA

Notice of Construction Application for Criteria/Toxic Air Pollutant Emissions from Thermal Stabilization of Polycubes at the Plutonium Finishing Plant

Nov. 29, 2000; 26 pp.; In English

Report No.(s): DE2003-805444; DOE/RL-2000-55; No Copyright; Avail: Department of Energy Information Bridge

This is a notice of construction (NOC) application for thermal stabilization of plutonium in a polystyrene matrix (polycubes) in the muffle furnaces at the Plutonium Finishing Plant (PFP). This NOC application is required by Washington Administrative Code (WAC) 173-460-040. During the 1960's and 1970's, polycubes were thermally stabilized using a pyrolysis process at PFP. The proposed process of thermal stabilization of polycubes in muffle furnaces results in emissions of air contaminants not emitted since implementation of WAC 173-460 (effective 9/11/91). The new process and related air contaminants are the basis for this NOC application. The proposed activity would use the muffle furnaces in the 234-52 Building to stabilize polycubes. The resulting plutonium oxides would be packaged to meet storage requirements specified in Stabilization, Packaging, and Storage of Plutonium Bearing Materials (DOE-STD-3013). The PFP is located in the 200 West Area of the Hanford Site. The PFP consists of several large and small buildings that are grouped to form the processing complex. The PFP activities are focused on the stabilization of plutonium-bearing materials to a form suitable for long-term storage; immobilization of residual plutonium-bearing materials; and removal of readily retrievable, plutonium-bearing materials left behind in process equipment and process areas.

NTIS

Air Pollution; Exhaust Emission; Plutonium; Stabilization; Toxicity; Industrial Plants

20030067442 TRW, Inc., Redondo Beach, CA

The Impact of Deorbiting Space Debris on Stratospheric Ozone

Lohn, Peter D.; Wong, Eric Y.; Molina, Mario J.; Denison, M. R.; May 31, 1994; 87 pp.; In English

Report No.(s): AD-A414310; No Copyright; Avail: CASI; [A05](#), Hardcopy

The Environmental Management of the Space and Missile Systems Command has set out to evaluate the depletion of stratospheric ozone caused by Air Force activities in space. Potential destruction of ozone by launch vehicle exhaust is one item of concern (Ref. 1.1). The use of advanced propellants to minimize launch-induced ozone destruction is discussed in a companion report. The present report describes a quantitative assessment of another potential destroyer of stratospheric ozone: deorbiting space debris. The results of the present study lead to the conclusion that deorbiting space debris has very little impact on stratospheric ozone.

DTIC

Ozonosphere; Launch Vehicles; Stratosphere; Ozone Depletion; Space Debris; Orbit Decay; Reentry

20030067470 TRW Space and Electronics Group, Redondo Beach, CA

Rocket Exhaust Impact on Stratospheric Ozone

Lohn, Peter D.; Wong, Eric P.; Smith, Tyrrel W., Jr.; Edwards, John R.; Pilson, Daniel; Sep. 30, 1999; 38 pp.; In English
Contract(s)/Grant(s): F09603-95-D-0176-0007

Report No.(s): AD-A414282; No Copyright; Avail: CASI; [A03](#), Hardcopy

The Environmental Management of the Space & Missile Systems Center (SMC) has set out to evaluate the depletion of stratospheric ozone caused by Air Force space activities. Earlier work supported by SMC included an assessment of the impact of deorbiting debris on stratospheric ozone (Reference 1.1) and the potential for reduction of ozone destruction by use of alternate propellants for launch vehicle rocket engines (Reference 1.2). A more recent effort, supported by SMC, addressed the impact of rocket exhaust on stratospheric ozone (Ref. 1.3). This work was an extension of an earlier study reported in Reference 1.4. The methodology described in Ref. 1.3 and 1.4 allows a quantitative assessment of the destruction of stratospheric ozone by rocket exhaust. The present study describes development and application of upgrades to the methodology by including and multiple engine effects as well as the effects of stratospheric winds.

DTIC

Air Pollution; Ozonosphere; Chlorine Compounds; Rocket Exhaust; Ozone Depletion

20030067529 Institute for Environmental Safety and Occupational Risk Analysis, Brooks AFB, TX, USA

Guide for Indoor Air Quality Surveys

Ronyak, James P.; Fox, Karen A.; Rybczynski, Ian C.; Cox, Kenneth L.; Feb. 2003; 91 pp.; In English

Report No.(s): AD-A414423; IERA-RS-BR-TR-2003-0001; No Copyright; Avail: CASI; [A05](#), Hardcopy

This report presents an informative, inclusive and concise process by which indoor air quality problems can be assessed in the field. It demonstrates the importance of team concepts for investigating problems and performing surveys. A history of indoor air quality is reviewed, including survey results by the indoor air quality survey team from the Air Force Institute of Environment, Safety and Occupational Health Risk Analysis. This report replaces AL-TR-1992-0016, Guide For Indoor Air Quality Surveys. However, much of the information in the 1992 Indoor Air Quality Guide (IAQ) is still current. Where applicable, some sections have been updated, whereas some new sections have been added to address problem areas the AFIERA Industrial Hygiene Branch has experienced on IAQ surveys. Recommendations are made that will improve the quality and efficiency of field investigations.

DTIC

Air Quality; Indoor Air Pollution; Surveys; Health Physics

20030067621 National Energy Technology Lab., Morgantown, WV, USA

Co-Firing Coal: Feedlot and Litter Biomass Fuels

Annamalai, K.; Jun. 14, 2002; 56 pp.; In English

Report No.(s): DE2002-802587; No Copyright; Avail: Department of Energy Information Bridge

Proposed activities for quarter 8 (3/15/2001-6/14/2002): (1) Continue the parametric study of cofiring of pulverized coal and LB in the boiler burner, and determining the combustor performance emissions of NO, CO, CO(sub 2), PO(sub 2) and P(sub 4)O(sub 10), etc. The air-fuel ratio, swirl number of the secondary air stream and moisture effects will also be investigated (Task 4). Gasification: (Task 3); (2) Measuring the temperature profile for chicken litter biomass under different operating conditions; (3) Product gas species for different operating conditions for different fuels; (4) Determining the bed ash composition for different fuels; (5) Determining the gasification efficiency for different operating conditions.

NTIS

Biomass; Coal; Combustion Chambers; Environment Pollution

20030067630 Fluor Daniel Hanford, Inc., Richland, WA, USA

Final Evaluation and Test Report for the Standard Waste Box (Docket 01-53-7A) Type A Packaging

Kelly, D. L.; Oct. 15, 2001; 132 pp.; In English

Report No.(s): DE2003-807487; HNF-8459-Rev-1; No Copyright; Avail: Department of Energy Information Bridge

This report documents the U.S. Department of Transportation Specification 7A Type A compliance test and evaluation results of the Standard Waste Box. Testing and evaluation activities documented herein are on behalf of the U.S. Department of Energy- Headquarters, Office of Safety, Health and Security (EM-5), Germantown, Maryland. Duratek Federal Services,

Inc., Northwest Operations performed an evaluation of the changes as documented herein under Docket 01-53-7A.
NTIS
Packaging; Radioactive Wastes; Containers; Specifications

20030067637 Helsinki Univ. of Technology, Espoo, Finland
Particle Agglomeration in Sulphatising Conditions: Literature Review

Nuirminen, E.; 2002; 28 pp.; In English

Report No.(s): PB2003-104828; TKK-MK-136; Copyright; Avail: National Technical Information Service (NTIS)

The purpose of this literature work is to get information about the agglomeration phenomena in sulphatising conditions. It aims to provide basic information about agglomeration of particles, the causes and the limiting conditions of the phenomena. To conduct the work, information about the agglomeration phenomena in sulphatising conditions was searched from periodically published scientific journals. A number of articles addressing the subject were collected. Most of the relevant articles address sulphatising conditions in fluidized bed combustors and the agglomeration resulting in the reaction of CaO to CaSO(sub 4).

NTIS

Agglomeration; Combustion Chambers; Air Pollution; Sulfur Dioxides

46 GEOPHYSICS

Includes Earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see *47 Meteorology and Climatology*; and *93 Space Radiation*.

20030066246 Rutherford Appleton Lab., Chilton

Physics of the Equatorial Atmosphere

Gray, L.; Hamilton, K.; Mar. 2003; 238 pp.; In English

Report No.(s): PB2003-105145; RAL-TR-2003-008; Copyright; Avail: National Technical Information Service (NTIS)

A School on 'Physics of the Equatorial Atmosphere' was held at the Abdus Salam International Center for Theoretical Physics from September 24 through October 5, 2001. The School was aimed primarily at advanced graduate students and young postdoctoral scientists with basic background in atmospheric science. The School lectures discussed a wide range of topics. The first week of lectures covered dynamics and transport in the low-latitude neutral atmosphere, with a focus on the stratosphere and mesosphere. The second week dealt with topics related to the equatorial ionosphere and magnetosphere. This volume reproduces slightly revised versions of some of the lecture notes from the first week of the School. The overall goal of this volume is to provide an informal survey of key issues in the meteorology of the low-latitude middle atmosphere.

NTIS

Atmospheric Circulation; Equatorial Atmosphere; Zonal Flow (Meteorology)

20030066253 Naval Health Research Center, Wright-Patterson AFB, OH, USA

Commentary and Scientific Review of Studies on Cardiac Function and Cardiac Sensitization Models

Brock, William J.; Kimmel, Edgar C.; Jederberg, Warren W.; May 2003; 98 pp.; In English

Report No.(s): AD-A414064; TOXDET-03-06; No Copyright; Avail: CASI; [A05](#), Hardcopy

During the 1980's and into the 1990's, international agreements were developed that led to the phase out of the chlorofluorocarbons (CFC) because of the demonstrated effect these compounds have on depleting the protective ozone layer in the upper atmosphere. Because of the elimination of these compounds, the chemical industry began to introduce replacement compounds that have little or no effect on the ozone layer. These compounds, the hydrochlorofluorocarbons (HCFC) and hydrofluorocarbons (HFC), were introduced as replacements for the CFC in a variety of applications including refrigeration, aerosol propellants and fire extinguishing agents. In the last 15 years, several toxicological testing and research programs were initiated to examine the potential adverse health effects of these new alternatives. For the class of fluorocarbons, cardiac sensitization remains a potentially serious health outcome of overexposure to these compounds. Although routine toxicological testing of these compounds normally includes an evaluation of this endpoint, it would be advantageous to the military use of these compounds if methods were developed that would allow prediction of cardiac sensitization before the onset of a fatal arrhythmia.

DTIC

Toxicology; Cardiovascular System; Flame Retardants; Heart Function; Chlorofluorocarbons

20030066570 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Rationale for Seismic Measurements on Mars by a Single Station

Lognonne, P.; Banerdt, W. B.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

We present here some of the scientific objectives which can be achieved by a single seismic station on Mars, equipped with a 3 axis VBB seismometer and a 3 axis Short Period Seismometer. We assume that this station is also equipped with meteorological sensors, including infra-sound and pressure, in order to perform a complete meteorological noise correction. The science objectives are listed in order of increasing difficulty.

Derived from text

Seismographs; Mars Environment

20030066615 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Studies of Rock Abrasion on Earth and Mars

Bridges, N. T.; Laity, J. E.; Greeley, R.; Phoreman, J., Jr.; Eddlemon, E. E.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Many field studies have been conducted that document the morphology of ventifacts and the directionality of their features relative to current and past wind regimes. Field plots and wind tunnel studies have identified heights and particle concentrations above the surface where maximum abrasion occurs. However, as of yet, the rates and detailed methods by which rocks abrade and evolve into ventifacts are poorly documented and understood. This abstract addresses this gap in knowledge by interpreting controlled laboratory and field analog studies. We begin with an overview of the methods by which the wind tunnel experiments and field studies were done, followed by how the resulting data were analyzed and interpreted. A presentation of the results comes next, after which the implications for rock abrasion and ventifact formation on Earth and Mars are discussed. We show that initial rock shape and texture play important roles in determining both rate and style of abrasion, with steep-sided, rough rocks eroding the fastest but with intermediate-angled faces exhibiting the greatest shape change. Most rocks tend to evolve toward an equilibrium shape whose form is poorly conducive to further abrasion. Most rocks on Mars and in terrestrial ventifact localities never reach this mature state, with erosion ceasing or slowing down due to exhaustion of the sand supply and other factors.

Derived from text

Geomorphology; Mars Surface; Earth Surface; Rocks; Wind Effects; Abrasion

20030066627 NASA Ames Research Center, Moffett Field, CA, USA

New Insights into the Geology of the Mars Pathfinder Landing Site from Spectral and Morphologic Analysis of the 12-Color Superpan Panorama

Murchie, S.; Barnouin-Jha, O.; Barnouin-Jha, K.; Bishop, J.; Johnson, J.; McSween, H.; Morris, R.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

New analyses of rocks and soils at the Mars Pathfinder landing site have been completed using the full Imager for Mars Pathfinder (IMP) 12- color SuperPan panorama. These revise early conclusions that rocks at the landing site are a single lithology coated only by windblown dust. We conclude instead that there is also a second lithology in addition to the dominant gray rock, and that it is consistent with highlands material excavated from beneath a thin veneer of northern plains; that many rocks have cemented coatings that formed during an early, probably wetter climate; and that young rocks excavated after coating formation ceased are mainly breccias or conglomerates.

Derived from text

Mars Surface; Planetary Geology; Morphology; Spectrum Analysis; Climate

20030066638 California Inst. of Tech., Pasadena, CA, USA

Polygonal Landforms at the South Pole and Implications for Exposed Water Ice

Piqueux, S.; Byrne, S.; Richardson, M. I.; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Polygonal terrain is a reliable indication of subsurface water ice. Following the discovery of exposed water ice on the

south polar layered deposits we searched for and mapped occurrences of polygonal terrain. Occurrences of polygons were found in regions interpreted to have exposed water ice at the surface.

Derived from text

Polygons; Water; Terrain; Ice; Polar Regions

20030066815 Army Research Lab. White Sands Missile Range NM, White Sands Missile Range, NM, USA
Surface Layer Stability Transition Research, Minimum Time Delay From Sunrise: 2001 March Case Study

Vaucher, Gail-Tirrell; Bustillos, Manny; Gutierrez, Alfred; May 2003; 64 pp.; In English

Report No.(s): AD-A413813; ARL-TR-2798; No Copyright; Avail: CASI; [A04](#), Hardcopy

Near surface target acquisition and EO propagation significantly improve during the Surface Layer Stability Transition (SLST). Thus, this research expands Army Chief of Staff Shinseki's vision from 'to see first' to, 'to see better.' The SLST is also starting and ending points for the atmospheric convection growth phase, an important factor in chemical warfare modeling. In 2001, the Meteorological-Sensors Integration Team of the Army Research Laboratory conducted the first of three field tests with the primary purpose of characterizing, modeling and exploiting repeatable patterns in the lower portion of the atmospheric boundary layer. The repeatable patterns investigated were the morning Stability Transitions (ST) or Neutral Events (NE). The 2001 March 20-22 test dates were selected based on a forecasted minimal time interval between the local Sunrise and an Ideal case NE. Two subsequent field tests addressed the maximum (June) and a second minimum (September) Sunrise-to-NE time interval. These latter Tests are documented separately. The Surface Layer Stability Transition research pursued two measurement and analysis methods: Eulerian (Tower data) and quasi-Lagrangian (Rawinsonde data). The results included validation data for the Ideal Neutral Event Forecast Model and a characterization of a desert stable-neutral-unstable morning transition over the Equinox time period. The information documented here serves as a useful building block in support of the primary goal.

DTIC

Atmospheric Boundary Layer; Atmospheric Circulation; Convection Currents; Optical Properties

20030067008 Lunar and Planetary Inst., Houston, TX, USA

Third International Conference on Large Meteorite Impacts

2003; ISSN 0161-5297; In English; Third International Conference on Large Meteorite Impacts, 5-7 Aug. 2003, Noerdlingen, Germany; See also 20030067009 - 20030067127; Original contains color and black and white illustrations

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1167; Copyright; Avail: CASI

The Third International Conference on Large Meteorite Impacts (formerly Large Meteorite Impacts and Planetary Evolution) was held August 5-7, 2003, at the Klosterle, Noerdlingen. The conference addressed a wide range of topics relating to planetary impacts and their effects on planetary crusts, climate, life on Earth, rocks, and rock-forming minerals. This CD-ROM contains the preface, table of contents, program, abstracts and indexes.

Derived from text

Conferences; Meteorite Collisions; Planetary Evolution; Meteorites; Meteorite Craters

20030067009 Arizona Univ., Tucson, AZ, USA

Numerical Simulations of Silverpit Crater Collapse

Collins, G. S.; Ivanov, B. A.; Turtle, E. P.; Melosh, H. J.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations

Contract(s)/Grant(s): NAG5-11493; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Silverpit crater is a recently discovered, 60-65 Myr old complex crater, which lies buried beneath the North Sea, about 150 km east of Britain. High-resolution images of Silverpit's subsurface structure, provided by three-dimensional seismic reflection data, reveal an inner-crater morphology similar to that expected for a 5-8 km diameter terrestrial crater. The crater walls show evidence of terrace-style slumping and there is a distinct central uplift, which may have produced a central peak in the pristine crater morphology. However, Silverpit is not a typical 5-km diameter terrestrial crater, because it exhibits multiple, concentric rings outside the main cavity. External concentric rings are normally associated with much larger impact structures, for example Chicxulub on Earth, or Orientale on the Moon. Furthermore, external rings associated with large impacts on the terrestrial planets and moons are widely-spaced, predominantly inwardly-facing, asymmetric scarps. However, the seismic data show that the external rings at Silverpit represent closely-spaced, concentric faultbound graben, with both

inwardly and outwardly facing fault-scarps. This type of multi-ring structure directly analogous to the Valhalla-type multi-ring basins found on the icy satellites. Thus, the presence and style of the multiple rings at Silverpit is surprising given both the size of the crater and its planetary setting. A further curiosity of the Silverpit structure is that the external concentric rings appear to be extensional features on the West side of the crater and compressional features on the East side. The crater also lies in a local depression, thought to be created by postimpact movement of a salt layer buried beneath the crater.

Author

Meteorite Craters; Ocean Bottom; Collapse; Mathematical Models

20030067010 University of Western Australia, Perth, Australia

Some Ring-like Magnetic Anomalies in Impact Structures and Their Possible Causes

Hawke, P. J.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

While not diagnostic of meteorite impact when used in isolation, geophysics is responsible for the initial discovery of many concealed craters. Airborne magnetism is one of the cheapest, and hence most widely available, of all the geophysical techniques. Based primarily on studies of craters formed in crystalline rocks, the definitive papers on the geophysical signatures of impact craters, suggest the main effect of extraterrestrial impact is to reduce the magnetic susceptibility of the target rock, resulting in an overall magnetic low or subdued zone. Local magnetic highs may be present, usually near the centre of complex structures. These are attributed to near surface magnetic basement within the central uplift of large structures or to shock, thermal and chemical processes forming new magnetic minerals or resetting magnetic remanence within the target rock or impact melt material. There are only a few case studies in the literature of magnetic surveys over true sedimentary targets, e.g. Mjoelnir and the sources of the observed magnetic anomalies are not well understood.

Derived from text

Meteorite Craters; Impact Melts; Magnetic Anomalies; Remanence

20030067011 Academy of Sciences (USSR), Moscow, USSR

Large Impact Crater Modeling: Chicxulub

Ivanov, B. A.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color and black and white illustrations

Contract(s)/Grant(s): RFBR Proj. 01-05-64564-a; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Every crater on Earth has its own specific. To model observed geological structure and geophysical anomalies one should tune a lot of model parameters without any guarantee the model in use is adequate to describe all involved natural processes. To start the process of modeling we need to make the first step using the 'standard' model based on first principles and laboratory data. The answer may be not very spectacular. However, only after the 'standard' modeling we can realize what else should be added for better understanding of what we see in the field. We present results of a 'standard' numerical modeling for Chicxulub.

Derived from text

Craters; Mathematical Models; Meteorite Collisions; Geophysics

20030067012 Karpinsky Geological Research Inst., Saint Petersburg, USSR

Original Diameter and Depth of Erosion of the Popigai Impact Crater, Russia

Masaitis, V. L.; Mashchak, M. S.; Naumov, M. V.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Veritable evaluations of diameters of large terrestrial impact structures remain questionable because most of the craters are essentially modified by erosion or buried beneath younger sediments. In contrary, about 35-Ma old Popigai impact structure (Northern Siberia) represents the well-preserved large impact structure. Its preservation and geological and geophysical studies carried out in its area allow precisely estimating its original diameter and depth of erosion.

Derived from text

Craters; Impact; Depth; Erosion; Geophysics

20030067014 Museum fuer Naturkunde, Berlin, Germany

The ICDP Drill Core Yaxcopoil-1, Chicxulub Impact Crater, Mexico: Shock Metamorphism of the Impactite Units (794-894 m)

Schmitt, R. T.; Wittmann, A.; Stoeffler, D.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color and black and white illustrations

Contract(s)/Grant(s): DFG-Ke-732/8-2; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The ICDP drilling Yaxcopoil-1 (Yax-1) in a distance of approximately 60 km from the center of the Chicxulub impact crater, Mexico exposes 795 m of Tertiary sediments, 100 m of allochthonous suevitelike, melt rich breccias resting on 616 m of obviously displaced Cretaceous sediments, which are cut by several impact dike breccias. The suevitic sequence is composed of six units: (1) Upper sorted suevite (794.63 807.75 m), (2) lower sorted suevite (807.75 823.25 m), (3) upper suevite (823.25 846.09 m), (4) middle suevite (846.09 861.06 m), (5) brecciated melt rock (861.01 884.96 m), (6) lower suevite (884.96 894.94 m). In this study we focus on the shock metamorphism of these six impactite units.

Derived from text

Drilling; Metamorphism (Geology); Meteorite Craters; Mexico; Mineralogy

20030067018 Imperial Chemical Industries Ltd., London, UK

Numerical Modelling of Impact Crater Collapse Utilising Different Constitutive Equations

Wunnemann, K.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Although it is now generally accepted that the heavily cratered landscapes on planets, e.g. the Moon, testify that impact cratering is an important geological process in the evolution of all planetary bodies, the process of crater formation itself is still not fully understood.

Derived from text

Mathematical Models; Impact; Planetary Evolution; Geology; Craters

20030067021 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin, Germany

A Model of Early Condensate Composition in Impacts

deNiem, D.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Anomalies of the abundance of siderophile elements in high-temperature condensates are among the most important tracers of terrestrial impacts. Initial pressures and temperatures during terrestrial impact are sufficient to cause complete vaporization of most of the projectile and a comparable amount of target rocks. The gas phase mostly consists of a large number of molecular species (oxides and other compounds) while pure atomic gases are far less abundant. Original meteoritic abundances are not likely to be preserved in high-temperature condensates. In early condensates, the concentration of siderophile elements occurs preferentially in small metallic grains. These grains can form under pressures comparable to or slightly larger than the ambient atmospheric pressure (at altitudes up to several tens of kilometers) and temperatures exceeding 3000 K.

Derived from text

Atmospheric Pressure; Atmospheric Chemistry; High Temperature; Impact

20030067022 Muenster Univ., Germany

On the Shock Behavior of Anhydrite and Carbonates: Is Post-Shock Melting the Most Important Effect? Examples from Chicxulub

Deutsch, A.; Langenhorst, F.; Hornemann, U.; Ivanov, B. A.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Original contains black and white illustrations

Contract(s)/Grant(s): DFG-DE-401/15-4; DFG-HO-1446/3-4; DFG-LA-830/4-4; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

To address the shock behavior of sulfate and carbonates, we performed shock experiments, and studied impact melt rocks, impact melt breccias, and suevites from Chicxulub drill cores.

Derived from text

Impact Melts; Core Sampling; Carbonates

20030067023 Moscow M. V. Lomonosov State Univ., Moscow, Russia

Transformation of Some Minerals in Shock Waves: Comparison of Natural and Experimental Data

Feldman, V. I.; Sazonova, L. V.; Kozlov, E. A.; Zhugin, Ju. N.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

There are some differences in natural and experimental shock-thermal aggregates (STA) in minerals of target rocks. For comparing the transformations of a matter in shock waves under natural meteoritic impact conditions and loading of a matter by spherical converging shock waves, the data on the Janisjarvi astrobleme and the on experiments with the rocks of its target have been used.

Derived from text

Meteorite Collisions; Impact Loads; Shock Waves

20030067025 Academy of Sciences (USSR), Moscow, USSR

The Lockne Crater: Shock Compression of Basement Rocks and Ejected Material

Ivanov, B. A.; Shuvalov, V. V.; Lindstrom, Maurits; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Introduction: The Lockne crater (D approx. 7km) has been formed under 500 to 700 m of sea water. The previous field investigations and numerical modeling (see latest publications) have revealed and explained several specific phenomena typical for the submarine impact cratering. Here we present some additional results of the numerical modeling targeted to expand the database for the comparison with geologic facts, collected for the Lockne structure.

Derived from text

Craters; Mathematical Models; Rocks; Shock Loads

20030067027 Rhode Island Univ., RI, USA

Geochemistry of Accretionary Lapilli from a Cretaceous-Tertiary Impact Breccia, Guayal, Mexico

Burns, E.; Sigurdsson, H.; Carey, S.; DHondt, S.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Accretionary lapilli are found in a 50- cm-thick grit unit that is 2.5 m below the top of a fining- upward, 35-m-thick impact breccia near Guayal, southeastern Mexico. They were first described in 2000 by Salge et al. [1]. The breccia is thought to be associated with the Cretaceous-Tertiary Chicxulub impact on Yucatan. It is about 600 km from the crater center and consists of carbonate clasts in a carbonatesmectite matrix. The smectite is the alteration product of impact glass. The accretionary lapilli are rounded and flattened, with the long axis lying parallel to bedding (Fig. 1). Average dimensions of a set of 24 lapilli, measured with calipers, are 1.3 x 1.1 x 0.8 cm (s.d. = 0.19, 0.14, and 0.16), with an average aspect ratio of 0.59 (s.d. = 0.13). They are the largest objects in the grit unit, which has carbonate clasts of <0.5 cm. The lapilli are about 90% silica and are medium grey in color, with a waxy luster on freshly broken or sawed surfaces. They appear to have been largely replaced by diagenetic chert, but retain the layered internal structure that is typical of accretionary lapilli (Fig. 2). The centers are amorphous. Outer layers contain angular mineral grains aligned tangentially to the curvature of the layers [1]. Quartz and pyroxene grains have been identified in thin section. The matrix is cryptocrystalline to amorphous, but layers tend to alternate between slightly coarser and finer textures.

Author

Breccia; Geochemistry; Craters

20030067028 Universidad Nacional Autonoma de Mexico, Mexico

Origin of Epidote from the Impact Melt of the Chicxulub Crater, Mexico

Lounejeva, E.; Elias-Herrera, M.; Ortega-Gutierrez, F.; Cedillo-Pardo, E.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Epidote is a typical mineral from low-grade metamorphic rocks, contact metasomatism and hydrothermal processes. Igneous epidote originally identified in deep-seated granitic plutons, has also been reported with growing frequency in shallow

intrusions. Normally it forms euhedral to anhedral crystals and appears in association with hornblende and biotite.
Derived from text
Craters; Crystals; Igneous Rocks; Impact Melts

20030067029 NASA Goddard Inst. for Space Studies, New York, NY, USA

Strangelove Ocean and Deposition of Unusual Shallow-Water Carbonates After the End-Permian Mass Extinction

Rampino, Michael R.; Caldeira, Ken; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The severe mass extinction of marine and terrestrial organisms at the end of the Permian Period (approx. 251 Ma) was accompanied by a rapid negative excursion of approx. 3 to 4 per mil in the carbon-isotope ratio of the global surface oceans and atmosphere that persisted for some 500,000 into the Early Triassic. Simulations with an ocean-atmosphere/carbon-cycle model suggest that the isotope excursion can be explained by collapse of ocean primary productivity (a Strangelove Ocean) and changes in the delivery and cycling of carbon in the ocean and on land. Model results also suggest that perturbations of the global carbon cycle resulting from the extinctions led to short-term fluctuations in atmospheric pCO₂ and ocean carbonate deposition, and to a long-term (>1 Ma) decrease in sedimentary burial of organic carbon in the Triassic. Deposition of calcium carbonate is a major sink of river-derived ocean alkalinity and for CO₂ from the ocean/atmosphere system. The end of the Permian was marked by extinction of most calcium carbonate secreting organisms. Therefore, the reduction of carbonate accumulation made the oceans vulnerable to a build-up of alkalinity and related fluctuations in atmospheric CO₂. Our model results suggest that an increase in ocean carbonate-ion concentration should cause increased carbonate accumulation rates in shallow-water settings. After the end-Permian extinctions, early Triassic shallow-water sediments show an abundance of abiogenic and microbial carbonates that removed CaCO₃ from the ocean and may have prevented a full 'ocean-alkalinity crisis' from developing.

Author

Extinction; Paleozoic Era; Carbonates; Ocean Models; Marine Biology; Chemical Composition; Alkalinity; Air Water Interactions; Shallow Water

20030067030 Toronto Univ., Ontario, Canada

Probing the Sudbury Structure at Depth: An ICDP Proposal

Mungall, J.; Milkereit, B.; Grieve, R.; Lesh, C. M.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Sudbury structure is the largest and best-exposed remnant of a large meteorite impact structure on earth. It hosts one of the world's largest concentrations of magmatic Ni-Cu-Pt-Pd-Au mineralizations and has produced more than \$100 billion worth of metal in over a century in production. It is a unique example of a large differentiated igneous body with remarkably simple boundary conditions (Fig. 1). As such it is the premier location on earth to study processes related to impact and planetary accretion, as well as a wide range of magmatic processes including the generation of large magmatic sulfide deposits. It is proposed to conduct a comprehensive program of research into the genesis and evolution of the Sudbury Structure centered on a scientific drilling program.

Author

Craters; Meteorites; Lithology; Magnetic Anomalies

20030067031 Oulu Univ., Finland

Kara Impact Structure, Russia: Recent Developments in Petrophysical and Geochemical Studies

Ohman, T.; Lorenz, K.; Pesonen, L. J.; Badjukov, D.; Raitala, J.; Elo, S.; Ojala, K.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Kara impact structure is located at 69 deg. 05 min. N 64 deg. 18 min. E, approx. 200 km north from the city of Vorkuta in arctic Russia. In the north it is bordered by the Kara Sea and in the south by the Pai-Khoi ridge. A number of studies have concentrated on the geology, geochronology, geochemistry and isotope systematics of the Kara structure, but very few geophysical and petrophysical studies exist. The age of the impact seems to be rather well constrained at 70.3 +/- 2.2 Ma (most

likely 68-70 Ma), but the diameter(s) (approx. 65-120 km and the number of craters in Kara area are still debated.

Derived from text

Craters; Geochemistry; Geochronology; Geophysics; Impact

20030067034 Academy of Sciences (USSR), Moscow, USSR

Mechanisms of Tsunami Generation by Impacts

Shuvalov, V. V.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

In this study an analysis of three regimes of underwater crater formation and tsunami generation by means of numerical modeling of the three terrestrial marine target impacts: Eltanin, Lockne, and Mjolnir are presented.

Derived from text

Mathematical Models; Tsunami Waves; Meteorite Craters; Geophysics; Marine Environments

20030067040 New Mexico Univ., Albuquerque, NM, USA

Bushveld Complex, South Africa: Impact and Plume Models Reconciled

Elston, W. E.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The (unpopular) impact model for the Bushveld Complex is based on evidence for an initial catastrophe, preserved in extraordinary high-temperature, high-energy debris flows at the base of its oldest unit (Rooiberg Group, approx. 2,061 Ma) and on intense deformation bracketed between the end of pre-Bushveld marine sedimentation and the coming-to-rest of the basal debris flows. The alternative (popular) mantle plume model is based on a long sequence of subsequent events related to sequential partial melting of mantle and crust: Evolution of the Rooiberg Group from diverse predominantly mafic flows to homogeneous siliceous flows of increasingly conventional volcanic aspect, overlapping with intrusion (into the base of the Rooiberg Group) and quiet differentiation of massive mafic cumulate sills (Rustenburg Layered Suite, RLS), followed by sills of A-type granite (Lebowa Granite Suite, LGS). The hydrodynamic model of Jones et al. for an impact-triggered longlived mantle plume promises to reconcile the two Bushveld models. It cites the Bushveld Complex as a possible example of a large igneous province generated by decompression melting at the leading edge of a shallow mantle plume, triggered by impact of an iron bolide ($d = 20$ km, $v = 10$ km/sec).

Author

Structural Basins; Earth Mantle; Meteorite Craters

20030067044 NASA Johnson Space Center, Houston, TX, USA

Experimental Simulation of Shock Reequilibration of Fluid Inclusions During Meteorite Impact

Madden, M. E. Elwood; Hoerz, R. J.; Bodnar, R. J.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations

Contract(s)/Grant(s): NSF EAR-01-25918; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Fluid inclusions are microscopic volumes of fluid trapped within minerals as they precipitate. Fluid inclusions are common in terrestrial minerals formed under a wide array of geological settings from surface evaporite deposits to kimberlite pipes. While fluid inclusions in terrestrial rocks are the rule rather than the exception, only few fluid inclusion-bearing meteorites have been documented. The rarity of fluid inclusions in meteoritic material may be explained in two ways. First, it may reflect the absence of fluids (water?) on meteorite parent bodies. Alternatively, fluids may have been present when the rock formed, but any fluid inclusions originally trapped on the parent body were destroyed by the extreme P-T conditions meteorites often experience during impact events. Distinguishing between these two possibilities can provide significant constraints on the likelihood of life on the parent body. Just as textures, structures, and compositions of mineral phases can be significantly altered by shock metamorphism upon hypervelocity impact, fluid inclusions contained within component minerals may be altered or destroyed due to the high pressures, temperatures, and strain rates associated with impact events. Reequilibration may occur when external pressure-temperature conditions differ significantly from internal fluid isochoric conditions, and result in changes in fluid inclusion properties and/or textures. Shock metamorphism and fluid inclusion reequilibration can affect both the impacted target material and the meteoritic projectile. By examining the effects of shock deformation on fluid inclusion properties and textures we may be able to better constrain the pressure-temperature path

experienced by shocked materials and also gain a clearer understanding of why fluid inclusions are rarely found in meteoritic samples.

Author

Meteorite Collisions; Fluids; Meteoritic Composition; Inclusions; Mechanical Shock; Impact Tests; Simulation

20030067049 California Univ., Los Angeles, CA, USA

Comparison of Distal Impact Spherules from KT Boundary and Late Eocene Deposits

Kyte, Frank T.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Distal impact spherules provide information about impact processes that cannot be perceived by analyses of impact craters or numerical models. Two rather well-studied impact spherule deposits which are also relatively well preserved are the KT boundary and the late Eocene deposit containing clinopyroxene-bearing (cpx) spherules. The KT boundary spherules are almost certainly directly related to the Chicxulub impact event, and the late Eocene cpx spherule deposit is commonly believed to be derived from the Popigai event. These are the two largest impact structures in the last 100 Ma. These deposits have several common features, which may reflect processes common to large-body impacts as well as significant differences. I will concentrate on data from the KT boundary at DSDP Site 577, western N. Pacific and Eocene ejecta from ODP Site 709, western Indian Ocean.

Derived from text

Impact; Deposits; Pyroxenes; Spherules

20030067051 Academy of Sciences (USSR), Moscow, USSR

Simulations of Very Large Impacts on the Earth

Svetsov, V. V.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The largest impact craters discovered on the Earth, from 200 to 300 km in diameter, could be produced by collisions with asteroids 10 20 km in size. However, the early Earth experienced intense bombardment of much larger bodies. The impacts of bodies 10 100 km in size have been studied in detail in numerous works. Giant impacts of Mars-sized bodies against the early Earth have been modelled and studied relatively well in several works. The authors carried out numerical simulations of vertical impacts of asteroids from 10 to 1600 km in size at 20 30 km/s. This is the only paper covering the range of asteroid sizes from 100 to 1000 km, however, many outcome characteristics of these impacts, necessary for determination of the early Earth state, have not been reported and the range of impact velocities did not include typical collision velocities which are smaller than 20 km/s. In this work, numerical hydrodynamic simulations have been made for vertical impacts of asteroids, from 100 to 1000 km in diameter, on the Earth. Impact velocities were from 10 to 20 km/s. The purpose of the simulations was to obtain the most important characteristics of the impacts: energy partitioning and mass distribution, mass captured to Earth-bound orbits and mass escaping the Earth gravitational field.

Derived from text

Meteorite Craters; Mathematical Models; Computerized Simulation; Earth Surface; Hydrodynamics; Geophysics; Hypervelocity Impact

20030067056 Consejo Superior de Investigaciones Cientificas, Madrid, Spain

The Sirente Crater Field: Outline, Age, and Evidence for Heating of the Target

Ormoe, J.; Rossi, A. P.; Komatsu, G.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

A field of small craters was recently discovered in the Apennines of central Italy. The crater field is located in a mountain plain about 85 km east of Rome. No bedrock is outcropping within the Sirente plain. All the craters are developed entirely in yellowish, clayey-silty unconsolidated sediment. Coarser material and even large limestone boulders occur sporadically in the sediment. A radiocarbon dating of the target surface below the excavated material of the rim of the largest crater suggests that it formed around AD 412 +/- 40. The target at Sirente is almost completely devoid of quartz and no shocked quartz has

been found. A geochemical study together with Christian Koeberl, University of Vienna, is ongoing, but has not yet revealed any meteoritic component in samples from the craters.

Derived from text

Chronology; Craters; Geochemistry; Heating; Time Measurement

20030067059 Southwest Missouri State Univ., Springfield, MO, USA

Weaubleau-Osceola Structure, Missouri: Deformation, Event Stratification, and Shock Metamorphism of a Mid-Carboniferous Impact Site

Evans, K. R.; Rovey, C. W., II; Mickus, K. L.; Miller, J. F.; Plymate, T. G.; Thomson, K. C.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Weaubleau-Osceola Structure in southwestern Missouri is a newly recognized 19-km-diameter circular feature that includes deformed Mississippian and older strata overlain by an event breccia and undeformed Pennsylvanian siliciclastic strata (Fig. 1). Recent discoveries of planar fractures and planar deformation features (PDF) in quartz from various breccia facies, variably oriented shatter-conelike striae in deformed strata, and coincidence of a low-gravity anomaly support the idea that it is a meteorite impact site.

Derived from text

Anomalies; Fractures (Materials); Meteorite Collisions; Stratification

20030067060 Texas Univ., Austin, TX, USA

Active Seismic and Drilling Studies of the Chicxulub Impact Crater: A Status Report

Gulick, S. P. S.; Christeson, G. L.; Morgan, J. V.; Warner, M. R.; Barton, P.; Urrutia-Fucugauchi, J.; Melosh, H. J.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The 65 Ma Chicxulub impact structure (Fig. 1) in Mexico is the largest Phanerozoic impact crater known on the Earth and likely records one of the more significant events in Earth history. Burial beneath ~1 km of Tertiary carbonates has preserved the crater in a uniquely pristine condition, where it is amenable to detailed investigation by drilling and surface geophysics. The Chicxulub crater was the focus of many past international efforts and is the focus of recent and upcoming efforts including continental (ICDP-1) drilling in 2002, future integrated ocean drilling program (IODP) drilling, and a combined 3D onshore/offshore tomographic study and 2-D/2.5-D seismic reflection survey planned for Spring 2004.

Author

Craters; Breccia; Ejecta

20030067062 Academy of Sciences (USSR), Moscow, USSR

Large Scale Impacts and Triggered Volcanism

Ivanov, B. A.; Melosh, H. J.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color and black and white illustrations

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The idea of impact induced volcanism continues to blossom ([1-3] and other references). However, this appealing idea is seldom supported with an appropriate physical mechanism. The aim of this publication is to critically examine some frequently cited mechanisms of impact energy transformation into a trigger for terrestrial volcanism and magmatism.

Derived from text

Volcanology; Meteorite Collisions; Seismic Waves; Earth Surface

20030067063 Stanford Univ., Stanford, CA, USA

Inferred Primary Compositions of Archean Spherules Formed by the Condensation of an Impact-produced Rock Vapor Cloud, Barberton Greenstone Belt, South Africa

Krull, A. E.; Lowe, D. R.; Byerly, G. R.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations

Contract(s)/Grant(s): NCC2-721; NAG5-9842; NSF EAR-99-09684; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Based on the lunar cratering record, impacts were larger and more frequent on the early Earth than they are today. There is no persevered record of these early terrestrial impacts because rocks of this age have been obliterated by tectonism and erosion. The oldest known evidence of impacts on Earth lies in four beds (S1, S2, S3 and S4) in the Barberton Greenstone Belt (BGB), South Africa, ranging in age from about 3.24 to 3.47 Ga. These beds are composed in large part of sand-sized spherical particles, termed spherules, that are thought to have formed by the condensation of rock vapor clouds ejected above the atmosphere as a result of large impacts. Spherule beds S2 and S3 are both about 20 cm thick where composed entirely of fall-deposited spherules and up to a meter thick where spherules are mixed with locally derived debris. The diameters the bolides have been estimated to be between 20 and 50 km, based on bed thickness, size of the largest spherules, Ir fluence and extraterrestrial Cr.

Derived from text

Vapors; Tectonics; Precambrian Period; Igneous Rocks; Cratering; Impact

20030067066 Museum fuer Naturkunde, Berlin, Germany

The Upheaval Dome Impact Crater, Utah: Combining Structural and Numerical Data to Constrain Age, Diameter, and Amount of Erosion

Kenkmann, T.; Ivanov, B. A.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color illustrations

Contract(s)/Grant(s): DFG-KE-732-6; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Upheaval Dome is located in southeastern Utah on the Colorado Plateau. The circular structure represents the remnant of a deeply eroded complex impact crater and provides spectacular insights into the architecture of a crater floor. By combining structural and numerical data we try to constrain the structure in time and space.

Derived from text

Colorado Plateau (Us); Craters; Erosion; Utah; Geochronology; Structural Properties (Geology)

20030067068 New Brunswick Univ., Fredericton, New Brunswick, Canada

Hypervelocity Impact into Carbonates: Processes and Products

Osinski, G. R.; Grieve, R. A. F.; Spray, J. G.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Carbonates are present in the target rocks of approximately one third of the world's known impact structures. An understanding of the response of carbonates to hypervelocity impact is needed in order to assess the effect of the impact process on these lithologies and the possible environmental influences such impacts may have had in the Earth's past. Despite the many uncertainties regarding the response

Derived from text

Hypervelocity Impact; Carbonates

20030067069 Universidad Nacional Autonoma de Mexico, Coyoacan, Mexico

Magnetostratigraphy of the K/T Boundary from Yaxcopoil-1 Borehole, Chicxulub Impact Crater

Rebolledo-Vieyra, M.; Urrutia-Fucugauchi, J.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Copyright; Avail: CASI; Abstract Only; Available from CASI only as part of the entire parent document

Recently a debate on the position of the K/T boundary within ICDP-UNAM borehole Yaxcopoil-1 has arisen. We report the magnetostratigraphy of K/T boundary and the base of Paleocene conducted on samples recovered by the Chicxulub Scientific Shallow Drilling Program. A sharp contrast of the magnetic susceptibility, from diamagnetic range up to $8000 \times 10(\exp -6)$ SI, marks the contact between the Tertiary and impact lithologies. Samples of impact breccias show a reverse polarities which spans up to approximately 40 cm into the Tertiary lithologies. We correlate this breccias to those of PEMEX borehole Yucatan-6, from which we tie our magnetostratigraphy to the radiometric age from this borehole. We consider that the reversal polarity within the impact breccias lies within the 29R chron, which contains the K/T limit. The Polarities recorded span from the magnetochron 29R to 29N. In this borehole we found a 36 cm interval between the K/T and the change in polarity, suggesting that the sedimentation during the 250,000 years from the K/T boundary to the polarity shift, was in the range of $6.5 \times 10(\exp -3)$ cm/yr, suggesting a very low sedimentation rate, or a hiatus of the base of Paleocene. We propose that the K/T limit in Yaxcopoil-1, is located at the contact between the impact series and the Tertiary sedimentary sequence,

at 794.43 m and not at the last occurrence of redeposited suevite at 794 m proposed by other authors.

Author

Boreholes; Cretaceous-Tertiary Boundary; Magnetostratigraphy; Meteorite Craters; Lithology

20030067070 Witwatersrand Univ., Johannesburg, South Africa

Authigenic and Allogenic Impact Breccias: Open Questions

Reimold, W. U.; Dressler, B. O.; Koeberl, C.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008

Contract(s)/Grant(s): ASF Proj. Y58-GEO; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Between the 1960s and 1980s, a considerable number of detailed, mostly mineralogical and geochemical studies of impact breccias in and outside of terrestrial impact structures, as well as in the available lunar rock and meteorite record, have been carried out. Since then, a rather limited number of groups has pursued this line of research. Many issues have remained either controversial or unresolved. This has recently been emphasized when a series of quite anomalous impact breccias were intersected in the Yaxcopoil-1 borehole in the Chicxulub impact structure. It, thus, is timely to revisit these impactite issues and attempt an inventory of current knowledge and remaining problematics. The timeliness of this attempt is further emphasized by the current efforts of impact researchers to compare their multidisciplinary data sets and cross-fertilize the discipline of impact cratering studies. Some questions that need to be addressed regarding the formation and emplacement of impactite deposits are presented.

Derived from text

Breccia; Geochemistry; Mineralogy; Geophysics; Geochronology; Meteorite Collisions

20030067071 Museum fuer Naturkunde, Berlin, Germany

Structural Characteristics of the Sudbury Impact Structure, Canada, Point to a Protracted Tectonomagmatic Evolution of the Sudbury Igneous Complex

Riller, U.; Dressler, B. O.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Sudbury Impact Structure, Ontario, is widely regarded as the relic of a large multi-ring impact basin, the centre of which is considered to be defined by the exposed portion of the synformal Sudbury Igneous Complex (SIC). In most impact models, the main mass of the SIC is believed to have formed entirely by fusion of upper crust followed by static differentiation of the resulting impact melt sheet into the observed basal quartzdioritic Sublayer and overlying norite, quartz gabbro and granophyre layers, respectively. Based on inference from crater-floor geometry of lunar multiring basins and numeric modelling, the basal contact of this melt sheet is required to have been horizontal prior to tectonic modification. Evidence for the multi-ring nature of the Sudbury Impact Structure hinges strongly on the assertion that zones of pseudotachylite and impact breccia in the tectonically least affected area north of the SIC connect to concentric zones, i.e. structural rings. By contrast, a number of well documented structural characteristics of the Sudbury Impact Structure have not been considered in any impact model but point to a more complex tectonomagmatic evolution of the Sudbury Impact Structure and as a consequence, of terrestrial multi-ring structures in general. The center of the Sudbury Impact Structure and its structural characteristics are discussed.

Derived from text

Structural Basins; Structural Properties (Geology); Canada; Tectonics; Meteorite Craters; Igneous Rocks

20030067072 Museum fuer Naturkunde, Berlin, Germany

Structural Investigations in the Central Uplift of the Upheaval Dome Impact Crater, Utah

Scherler, D.; Jahn, A.; Kenkmann, T.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations

Contract(s)/Grant(s): DFG-KE-732-6; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Upheaval Dome structure is a morphological expression of variously deformed sedimentary rocks in the otherwise relatively flat lying rocks of the Colorado Plateau in SE Utah. It has been identified to be an impact structure by early workers such as Shoemaker et al. in 1983. Even though Jackson et al. proposed a concurring genetic theory of salt tectonics, geological and geophysical contributions as well as recent rock mechanical evidence provides us with the impact-theory as the most

favorable starting point for a kinematic model of the structure's genesis. Using geological and structural features, which were mapped during a field campaign in the innermost part, comprising of layered Triassic rocks (Chinle & Moenkopi formations), we generated a 3D-model using ArcGIS and the 3D-Analyst by ESRI. In addition to the mapping, several samples of the outcropping lithologies were taken to compare their microstructure with respect to those of undeformed samples in later work. By combining field observations with the visualization benefits of a 3D-model, important structural elements, their lateral development and relevance for uplifting material shall provide helpful insights on the formation of a central uplift in a layered target. The spatial distribution of the dipping strata, faults, folds and cataclastically deformed rocks were used for imposing constraints on the kinematics of central uplift formation during crater collapse. The work is in progress and displayed are the results so far. Further processing of the data shall result in a structure-map of marker horizons, the 3D-visualization of faults and eventually a balanced restoration of movements during crater collapse.

Author

Sedimentary Rocks; Domes (Structural Forms); Craters; Geology; Deformation

20030067073 Carleton Univ., Ottawa, Ontario, Canada

Magnetic Fabric Studies of the Whistle and Parkin Offset Dykes from the Sudbury Impact Structure

Giroux, L. A.; Benn, K.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Quartz-diorite Offset dykes from the 1.85 Ga Sudbury Impact Structure stem from the Sudbury Igneous Complex (SIC) and extend into the footwall rocks of the impact structure, forming radially and concentrically arranged intrusions. The dykes represent impact-generated magmas emplaced into radial and concentric fractures that were generated in the country rock by the hypervelocity impact. The Parkin and Whistle Offset dykes are located to the northeast of the SIC. The Parkin Offset dyke may be a faulted extension of the Whistle Offset dyke.

Derived from text

Fractures (Materials); Hypervelocity Impact; Rocks

20030067074 City of Buenos Aires, Buenos Aires, Argentina

Bajo Hondo, a Very Puzzling Crater in Chubut, Patagonia, Argentina

Rocca, M. C. L.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Bajo Hondo is a very puzzling crater in Chubut Province, Patagonia, Argentina, (S 42 15 W 67 55). Diameter: 4.8 kilometers. It has a 100-150 meters raised rim and several decametric blocks are visible on its Western rim. Its proportions match perfectly those of a simple impact crater. Bajo Hondo is located in the Somuncura Plateau, 10 km. SE to the Talagapa stratovolcano. The whole Somuncura Plateau is composed of volcanic rocks, mainly Oligocene-Miocene basaltic floods and ignimbrite deposits. Bajo Hondo has been interpreted in the past as a collapsed basaltic caldera. The same happened in the case of Lonar Lake, India: a 1.8 kilometers well confirmed impact crater in the Deccan Basaltic plateau. However close examination of satellite LANDSAT images and aerial photographs of Bajo Hondo reveals possible flaws in that interpretation. A reported volcanic cone on the Western rim is probably just a collapsed part of that rim. The association of lava floods to Bajo Hondo is also doubtful. Probably the reported ones were erupted by Talagapa and not by Bajo Hondo itself. Rocks exposed on Bajo Hondo's rims are clearly piroclastic: basaltic breccia, glass bombs and glassy scoriae. Those rocks are present in Lonar Lake's rim. Explosive origin is evident. The question is: Volcanic or Impact? Bajo Hondo is probably too big to be a Maar. The author believes it is in fact a misinterpreted gigantic simple impact crater. If it is in fact an impact then Bajo Hondo is very important because it would be a gigantic simple crater and at the same time an impact crater in basaltic rocks. The site demands more research.

Derived from text

Craters; Impact; Deposits

20030067076 Mainz Univ., Germany

Composition of the Late Influx of the Earth

Schmidt, G.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Many authors explain the relative high abundances of HSE and their broadly chondritic proportions in the Earth's mantle

(PUM) by the addition of a late chondritic veneer after core formation. Many recent studies have documented significant regional variations in absolute HSE abundances and inter-element ratios in mantle samples. Such variations may have been caused by complex geochemical processes such as partial melting, melt percolation and aqueous metasomatism in the subcontinental lithosphere. For a better characterisation of the late veneer component(s) of the Earth I review here selected neutron activation data from our own studies for orogenic spinel lherzolites that have suffered only slight melt depletion (Ca/Si greater than 0.086) and compare this data with selected data from the literature.

Derived from text

Earth Mantle; Geochemistry; Metamorphism (Geology); Lithosphere; Structural Properties (Geology)

20030067080 Witwatersrand Univ., Johannesburg, South Africa

Vredefort 2003: Recent Progress, New Challenges

Gibson, R. I.; Reimold, W. U.; Lana, C.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Archean and Paleoproterozoic rocks of the Witwatersrand region in South Africa preserve a unique deep section through the giant, 2.02 Ga, Vredefort Impact Structure. This paper outlines some of the advances made in the last 5 years in understanding the nature of the impact processes that affected these rocks, and some of the ongoing work and outstanding challenges that remain. Field and petrographic research has centered on the approximately 80-km wide central uplift of the structure (the Vredefort dome), which exposes a 35-40 km wide early Archean crystalline basement core and surrounding 15-20 km wide collar of steeply-dipping younger supracrustal strata. Research in the outer parts of the impact structure has been largely restricted to petrographic work on the gold-bearing strata of the Witwatersrand basin aimed at understanding impact-induced thermal effects in the crater basement. The absence of crater-fill impact melt rock and other breccias confirms the deep level of erosion of the structure, which is estimated at between 5 and 10 km.

Derived from text

Petrography; Sedimentary Rocks; Precambrian Period; Meteorite Craters; Structural Basins

20030067082 Wester Tillyrie House, Kinross, UK

The Loch Leven Crater: Anatomy of a Low-Angle Oblique Impact Structure

Hamill, B. J.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Loch Leven basin (56 12 deg. N, 3 23 deg. W) in the Midland Valley of Scotland has been identified as the site of the primary impact of a low-angle oblique impact event dating from the end of the Carboniferous. Together with two further downrange structures, it forms a chain of craters which appear to have been produced by fragments of a large asteroid which disintegrated on impact.

Derived from text

Asteroids; Craters; Downrange

20030067087 Geological Survey, Reston, VA, USA

Recent Research in the Chesapeake Bay Impact Crater, USA, Part 2, Reworked Ejecta and Impact Debris

Horton, J. W., Jr.; Gohn, G. S.; Edwards, L. E.; Self-Trail, J. M.; Powars, D. S.; Kunk, M. J.; Izett, G. A.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Chesapeake Bay impact structure on the Atlantic margin of Virginia, USA, is a late Eocene, 85-km-wide, complex crater formed in a continental-shelf environment. The wet target consisted of seawater (~300 m) underlain by lower Tertiary and Cretaceous unconsolidated sediments (400 to >750 m) and crystalline basement. A 38-km-wide, excavated inner crater is surrounded by a flat-floored annular trough, which has an outer rim of collapsed fault blocks. These features are surrounded by concentric faults and preserved beneath 150-400 m of post-impact sediments. In the annular trough, pre-impact Cretaceous sediments now constitute parautochthonous unit A that is block faulted, locally fluidized, and gradational upward into unit B that shows extensive fluidization, infiltration, and mixing. The disrupted preimpact sediments were scoured and covered by seawater resurge deposits of the Exmore diamict. The Exmore consists of mixed Lower Cretaceous to upper Eocene sediment clasts (up to boulder size) and minor crystalline-rock clasts in a matrix of glauconitic, quartz-rich, muddy sand that contains Cretaceous, Paleocene, and Eocene fossils [1,2]. Recent drill cores from the western annular trough at Bayside (728.5

m deep), the NASA Langley Research Center (635.1 m deep), and North (435.1 m deep), and a core from the outer rim at Watkins School in Newport News (300.3 m deep), are 8, 19, 24, and 27 km, respectively, outside the inner crater. All four cores penetrated the Exmore diamicton, and cores from Bayside and Langley sampled complete post-impact and crater sections down to Neoproterozoic granites of a peri-Gondwana basement terrane [1].

Author

Breccia; Core Sampling; Ejecta; Craters; Geochemistry

20030067091 New Brunswick Univ., Fredericton, New Brunswick, Canada

Localized Shock Excursions in Martian Meteorites: The Los Angeles Basaltic Shergottite and North West Africa 1183 Olivine-Phyric Shergottite

Walton, E. L.; Spray, J. G.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Shock waves are produced naturally by the hypervelocity impact of extraterrestrial bodies. The resultant shock metamorphic effects are a feature common to all meteorites (e.g., chondrites, irons, achondrites, SNCs). It is imperative to have a complete understanding of the effects of shock on the SNCs, as these features reflect normal geological processing by impact of material on the Martian surface. The Los Angeles and NWA1183 meteorites have not undergone any detailed studies of their shock metamorphic effects, despite the presence of localized shock excursions manifest as discrete melt pockets, veins and dikelets. As such, this study is devoted to the characterization and description of shock metamorphic effects using analytical electron microscopy, as recorded in the NWA1183 and Los Angeles shergottites. Method: One large thick section of NWA1183 Derived from text

Mars Surface; Olivine; Shergottites; Shock Waves; Hypervelocity Impact

20030067094 Museum of Natural History, London, UK

Spinel Heterogeneity Within Individual Impact Spherules from the K/T Boundary: Implications for Modelling of Impact Plume Conditions

Kearsley, A. T.; Graham, G. A.; Jones, A. P.; Friend, C. R. L.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Minerals of the spinel group have been reported widely from sedimentary sequences that span the boundary between the Cretaceous and Paleogene Systems. Distinctive nickel-bearing spinels are found associated with other evidence of global catastrophe due to major impact of an extraterrestrial body. Loose spinel grains can be easily extracted from soft sediment samples (e.g. deep sea sediment cores), and are readily concentrated by magnetic and density techniques. In many cases they show a dendritic morphology that suggests that they have grown rapidly. Unfortunately, disaggregated samples usually do not preserve the textural relationship between spinel and other minerals, and may break fragile, complex grains into large numbers of skeletal fragments. As a consequence, it can be very difficult to determine the history of changing spinel composition that may reflect an evolving petrological environment.

Derived from text

Boundaries; Cores; Spinel; Textures

20030067095 Princeton Univ., NJ, USA

Chicxulub Impact Predates K-T Boundary: Supports Multiple Impact Hypothesis

Keller, G.; Stinnesbeck, W.; Adatte, T.; Stueben, D.; Kramar, U.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Yaxcopoil 1, drilled on the inner flank of the transient cavity of the Chicxulub crater, was expected to yield the final proof that this impact occurred precisely 65 m.y. ago and caused the mass extinction at the Cretaceous-Tertiary (K-T) boundary. Instead, contrary evidence was uncovered. Biostratigraphic, sedimentologic and geochemical investigations reveal that the Chicxulub impact predates the K-T boundary by nearly 300 k.y. and did not cause the end- Cretaceous mass extinction.

Derived from text

Craters; Impact; Geochemistry; Cretaceous-Tertiary Boundary

20030067096 Witwatersrand Univ., Johannesburg, South Africa

New Evidence Related to the Formation of Shatter Cones; with Special Emphasis on Structural Observations in the Collar of the Vredefort Dome, South Africa

Wieland, F.; Reimold, W. U.; Gibson, R. L.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Shatter cones have been studied for decades without fully resolving their formation. New field observations on shatter cones from the Vredefort Dome give new insight into the formation of this impact deformation phenomenon. The orientations of shatter cone apices, as observed in the field, are not uniform with regard to the center of the structure, and show a variety of prominent directions: most apex orientations are normal to the strike of the bedding (and parallel to the dip direction of the bedding plane), as well as parallel to the strike (and normal to the dip direction of the bedding plane). No relationship exists between angles of striations, i.e., protruding bundles of striations on shatter cone surfaces as defined by Sagy et al., and the distance of sample location from the crater center. In this study, samples were collected from and in situ striation orientation measurements were performed at a number of sites throughout the northern collar of the Vredefort Dome, extending to about 60 km from the center of the core. These sites occur in different lithological units, all of them belonging to the Witwatersrand, Ventersdorp and Transvaal supergroups. Surfaces of shatter cones from other impact sites, including Canada and Germany, were also studied.

Derived from text

Lithology; Republic Of South Africa; Shatter Cones; Strata; Structural Properties (Geology); Striation

20030067097 Wien Univ., Austria

Proposed Scientific Drilling at the Bosumtwi Impact Structure, Ghana, West Africa

Koeberl, C.; Milkereit, B.; Overpeck, J.; Scholz, C.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The 10.5 km diameter Bosumtwi impact crater in Ghana is almost completely filled by Lake Bosumtwi. The crater has an age of 1.07 Ma and was excavated in lower greenschist facies metasediments of the 2.1-2.2 Ga Birimian Supergroup. The Ivory Coast tektites and microtektites originated from this crater. A first high-resolution aerogeophysical survey was conducted in early 1997. Since then several projects have dealt with land- and lake-based geophysical measurements and surface geological and geochemical investigations regarding the subsurface topography of the structure. The results from these studies provided all the background work necessary to characterize the subsurface structure of the Bosumtwi crater that are necessary to define the targets for a deep drilling program. Such a deep drilling project, proposed by the authors, has recently been approved by the International Continental Scientific Drilling Program (ICDP). Drilling is desirable for several reasons, including 1) to obtain a complete 1 million year paleoenvironmental record in an area for which so far only limited data exist; 2) to study the subsurface structure and crater fill of one of the best preserved large young impact structures. Understanding the full range of climate variability in this region over the last 1Ma will thus fill a major hole in our understanding of global climate dynamics, and thus also lead to an enhanced climate prediction capability over a broad part of the earth. In terms of cratering studies, Bosumtwi is one of only two known young craters of this size, and may have a crucial diameter at the changeover between a traditional 'complex' crater with a central peak and a crater structure that has a central peak-ring system.

Author

Drilling; Geochemistry; Geophysics; Ghana; Africa; Meteorite Collisions

20030067098 Wien Univ., Austria

A 2003 Expedition into the Libyan Desert Glass Strewn Field, Great Sand Sea, Western Egypt

Koeberl, Christian; Rampino, Michael R.; Jalufka, Dona A.; Winiarski, Deborah H.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations
Contract(s)/Grant(s): Proj. Y58-GEO; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Libyan Desert Glass (LDG) is an enigmatic type of natural glass that is found in an area with an extension of several thousand square kilometers. Literature values on the extent vary between about 2000 and 6500 sq km. This area, or strewn field, is located between sand dunes of the southwestern corner of the Great Sand Sea in western Egypt, near the border to Libya. Therefore, the name 'Libyan' Desert Glass is not entirely correct, given today's geographical boundaries, but refers to the traditional name of the desert. P.A. Clayton was the first to travel the region in the early 1930s and to collect glass samples

that were used to provide the first detailed scientific description of the glass and its occurrence. In addition, R. A. Bagnold visited the LDG area in the 1930s. The inaccessibility of the LDG area was the reason for a relative paucity of visits to the location. In the 1970, visits by, for example, J.R. Underwood, E. P. Fisk, and V.E. Barnes led to the collection of a large number of LDG samples and some petrographical work. In addition, two impact structures were discovered just west of the LDG strewn field, just over the border in Libya: the B.P. and the Oasis impact structures, which are of interest because of a possible connection with the origin of the LDG; see below for a more detailed discussion. Petrography and Geochemistry:

Derived from text

Petrography; Glass; Sands

20030067099 Bayreuth Univ., Germany

First Observation of Silicate Hollandite in a Terrestrial Rock

Langenhorst, F.; Dressler, B.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

At high pressures in excess of 10 GPa, feldspars undergo phase transformations to hollandite-structured polymorphs. Such silicate hollandite is expected to occur in subducted oceanic slabs at inaccessible depth in Earth's mantle but it can also occur in the context of bolide impact events. In fact, silicate hollandite has recently been discovered in shock veins of heavily shocked ordinary chondrites and the SNC achondrite Zagami but so far it has never been reported for a terrestrial rock. This transmission electron microscope (TEM) study reports the first discovery of terrestrial silicate hollandite in a strongly shocked anorthosite from the central uplift of the Manicouagan impact crater, Canada.

Derived from text

Rocks; Silicates; Earth Mantle; Veins (Petrology); Petrography

20030067110 New Mexico Univ., Albuquerque, NM, USA

Evidence for Impact-induced Hydrothermal Alteration at the Lonar Crater, India, and Mistastin Lake, Canada

Newsom, H. E.; Hagerty, J. J.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAG5-8804; NAG5-10143; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The 50,000 year old, 1.8km diameter Lonar crater is located in Maharashtra, India. This relatively small crater is of particular interest because of its unique morphological and mineralogical properties, which make it a valid analogue for similar craters on the surface of Mars. We show that even in this relatively small crater, substantial hydrothermal alteration of shocked breccias in the floor of the crater has occurred, probably due to the thermal effects of the impact event. The 38 my old, 28 km diameter, Mistastin crater contains an 80 m thick impact melt sheet. We have also documented the presence of alteration phases in the material from this larger crater.

Author

Meteorite Craters; Impact Melts; Earth Surface

20030067111 Arizona Univ., Tucson, AZ, USA

Numerical Modeling of Large Impacts

Melosh, H. J.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Large meteorite impacts are among those phenomena that are either too large or too dangerous to study experimentally. Although impacts have affected the formation and surfaces of nearly every body in the solar system, we are limited to observing the results of past events. Investigation of impact processes is thus divided into observational studies of the traces of past impacts, small-scale analogue laboratory experiments and, most recently, detailed computer modeling. Computer models offer the possibility of studying craters at all scales, provided we completely understand the physics of the process and possess enough computer power to simulate the features of interest.

Derived from text

Computerized Simulation; Numerical Analysis; Impact; Craters

20030067116 Arizona Univ., Tucson, AZ, USA

On the Decoupling of Microtektites from the Ejecta Plume

Lorenz, R. D.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Cratering on planetary bodies with atmospheres entails significant interaction of ejecta with the atmosphere. In addition to the obvious (to remote sensing) proximal effects associated with blast and wake scouring and the restraint of the ejecta curtain to form lobate blankets rather than rays, the atmosphere as a whole controls the expansion of the impact fireball and the subsequent release of fine particulates entrained in, or condensing from, it. The details of this process must control the distribution of microtektites which are distributed on exoatmospheric (i.e. ballistic) trajectories after release. Here I aim to connect the distribution of launch parameters (velocity, angle, altitude) with the particle size: this association should shed light on the plume expansion and particle launch process.

Derived from text

Ejecta; Plumes; Meteorite Craters; Decoupling

20030067117 Toronto Univ., Ontario, Canada

Another Look at the Geophysical Signature of Large Terrestrial Impact Structures

Milkereit, B.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Most terrestrial impact craters exhibit geophysical signatures [1]. Recently, integration of results from seismic surveys, potential field studies, remote sensing, exploration drilling and numerical modelling of impact processes constrain the size and shape of transient craters and provide images of impact basin morphology. Common features of geophysical studies across the Vredefort (South Africa - diameter: 300 km; age: 2006 Ma), Sudbury (Canada - 250 km; 1850 Ma), Chicxulub (Mexico - 180 km; 65 Ma), Ries (Germany - 24 km; 15 Ma), and Bosumtwi (Ghana - 10 km; 1 Ma) structures are reflective target stratigraphy, quiet postimpact sedimentation, and prominent magnetic anomalies. The reflective target stratigraphy provides some information about the size of the transient crater and capture the footprint of crater collapse such as broad terraces, fault offsets and slumped blocks. The quiet post-impact sedimentation follows the redistribution of ejecta by high-energy wave action or crater wall slumping.

Author

Ejecta; Craters; Magnetic Anomalies; Slumping

20030067120 Westfaelische Wilhelms Univ., Muenster, Germany

Oceanic Impacts, Tsunamis, and the Influence of the Water Depth on the Quantity and Characteristics of the Generated Waves

Weiss, R.; Wuennemann, K.; Bahlburg, H.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

This study focuses on the variation of the quantity and the characteristics of transmitted tsunami waves due to an oceanic impact. To attain the goal, we are utilising different numerical models, which compute the impact process and the wave propagation. The impact model is used to calculate the initial conditions (the number of tsunami waves and their characteristics) for the wave propagation model, by varying the H/d ratio. The computation of the wave propagation allows to study the change of the wave characteristics during the propagation over an artificial bathymetry.

Author

Mathematical Models; Tsunami Waves; Wave Propagation; Meteorite Collisions

20030067124 Toronto Univ., Ontario, Canada

Magnetic, Gravity and Seismic Constraints on the Nature of the Wanapitei Lake Impact Crater

LHeureux, E.; Ugalde, H.; Milkereit, B.; Eyles, N.; Boyce, J.; Morris, W.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Wanapitei Lake impact crater (46 deg 45 min N, 80 deg 45 min W) is located in Northern Ontario, bounded on its West side by the deformed East rim of the 1.85 b.y. old Sudbury impact structure. The crater is believed to be of medium size (with a diameter of approximately 7.5 km) and lies entirely within the central, circular portion of the 9 km diameter Wanapitei

Lake. Because the crater lies underwater, there are few constraints on its actual size: its suggested diameter is based solely on one gravity survey. There are only few samples presenting shock metamorphic features in proximity of the lake, all of which come from glacial drift South of Wanapitei. The regional setting of Lake Wanapitei presents a unique opportunity for the study of impact craters. Prominent diabase dikes extend for several kilometers across both the Sudbury structure and the lake, offering clear markers indicative of large tectonic or structural disruptions. For this study we used these dikes as a new method for delineating the crater's structure, as brecciation will have an effect on both densities and magnetic susceptibilities of target rocks, disrupting any linear anomalies produced by them. In addition, geophysical surveying over the crater is facilitated by the fact that it lies underwater, allowing for faster marine surveying.

Derived from text

Geophysics; Metamorphism (Geology); Seismology; Gravitation; Magnetic Effects; Lakes; Lunar Craters

20030067125 Stockholm Univ., Sweden

An Array of Offshore Impact Craters on Mid-Ordovician Baltica

Lindstroem, Maurits; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The purpose of this paper is to discuss paleodepths at five sites of offshore impact and relate them to the geological situation on the paleocontinent Baltica. The target in all cases consisted of Proterozoic crystalline rocks that were overlain by about 80-150 m thick Cambrian and Ordovician sediments. These sediments, which were in their turn covered by different depths of water, had well lithified limestone only in their uppermost 20-50 meters. Sands and clays, forming the lower part of the sediment cover, were to a large extent nonlithified. The impact structures vary in their mode of preservation, but all have a distinct morphologic crater excavated in the crystalline basement. This excavation is the only preserved part of the apparent crater in two of the cases. Its width, henceforth referred to by theta may be appreciably smaller than the transient crater that formed in water. The localities of the craters are provided.

Derived from text

Precambrian Period; Meteorite Craters; Geomorphology; Sedimentary Rocks

20030067224 Massachusetts Univ., Amherst, MA

High-Resolution S-band Profiling of the Atmospheric Boundary Layer

Frasier, Stephen J.; Nov. 4, 2002; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAG55-98-1-0513

Report No.(s): AD-A413555; No Copyright; Avail: CASI; [A03](#), Hardcopy

An S-Band FMCW atmospheric radar was constructed, tested, and operated during the 1999 Cooperative Atmosphere Surface Exchange Study nocturnal boundary layer experiment (CASES-99). There the radar system provided real-time guidance to research aircraft and other sensors in locating gradients and turbulent layers. We participated in three subsequent CASES workshops and submitted a journal paper describing the instrument and initial CASES results. Finally, we have performed coordinated observations with the TEP radar at Amherst during 2001 and 2002.

DTIC

Turbulent Boundary Layer; Atmospheric Chemistry; Atmospheric Circulation; Turbulence; Atmospheric Boundary Layer

20030067291 Massachusetts Univ., Amherst, MA

Use of Turbulent Eddy Profiler in Making Atmospheric Boundary Layer Measurements

Schaubert, D. H.; Frasier, S. J.; Carswell, J. R.; Mar. 12, 2002; 18 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0480

Report No.(s): AD-A414537; ARO-38705.2-EV; No Copyright; Avail: CASI; [A03](#), Hardcopy

Following the purchase of a new TEP data acquisition system, TEP was deployed, along with UMass' FMCW profiler, during the CASES'99 Nocturnal Boundary Layer experiment near Leon, KS. During and following the experiment, several problems were identified in the new data acquisition system, and transmitter. During 2000, data acquisition problems were debugged, and a replacement transmitter was obtained in Spring 2001. TEP and the FMCW were deployed at a local field site in Amherst, MA. Coordinated operations confirmed successful operation of TEP, and collaborations with researchers at NQAA/ETL and U Nebraska are underway.

DTIC

Turbulent Boundary Layer; Atmospheric Boundary Layer; Transmitters

20030067425 NASA Marshall Space Flight Center, Huntsville, AL, USA

Self-Consistent Magnetosphere-Ionosphere Coupling: Theoretical Studies

Khazanov, G. V.; Liemohn, M. W.; Newman, T. S.; Fok, M.-C.; Spiro, R. W.; Journal of Geophysical Research; January 2003; ISSN 0148-0227; Volume 108, No. A3, pp. 14-1 - 14-11; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-4771; NAG5-6976; NCC8-181; Copyright; Avail: Other Sources

A theoretical examination of the electrodynamical interaction between the ionosphere and the inner magnetosphere is presented. A self-consistent ring current (RC) model has been developed that couples the electron and ion magnetospheric dynamics with the calculation of the electric field. Two new features were taken into account in order to close the self-consistent magnetosphere-ionosphere coupling loop. First, in addition to the RC ions, we have solved an electron kinetic equation in our model. Second, using the relation of Galand and Richmond [2001], we have calculated the height integrated ionospheric conductances as a function of the precipitated high energy magnetospheric electrons and ions that are produced by our model. To validate the results of our model we simulate the magnetic storm of May 2, 1986, a storm that has been comprehensively studied by Fok et al. [2001], and have compared our results with different theoretical approaches. The self-consistent inclusion of the hot electrons and their effect on the conductance results in deeper penetration of the magnetospheric electric field. In addition, a slight westward rotation of the potential pattern (compared to previous self-consistent results) is evident in the inner magnetosphere. These effects change the hot plasma distribution, especially by allowing increased access of plasma sheet ions and electrons to low L shells. These results are consistent with recent observations from the IMAGE Satellite.

Author

Magnetosphere-Ionosphere Coupling; Self Consistent Fields; Electrodynamics; Ring Currents; Mathematical Models

20030067457 TRW, Inc., Redondo Beach, CA

Stratospheric Effects of Rocket Exhaust: Heterogeneous Processes

Molina, Mario J.; Edwards, John R.; Pilon, Daniel; Smith, Tyrrel W., Jr.; Sep. 30, 1999; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F09603-95-D-0176

Report No.(s): AD-A414333; No Copyright; Avail: CASI; [A03](#), Hardcopy

The focus of this project has been the laboratory investigation of chemical processes involving the effects of particles emitted by solid rocket motors (SRMs) on stratospheric ozone. Emphasis has been placed on the efficiency of the catalytic chlorine activation process occurring on the surface of aluminum oxide particles.

DTIC

Heterogeneity; Stratosphere; Rocket Exhaust; Ozone Depletion

20030067461 TRW, Inc., Redondo Beach, CA

Utilization of Alternate Propellants to Reduce Stratospheric Ozone Depletion

Lewis, David H.; Trost, Jack E.; Wong, Eric Y.; English, W. D.; May 31, 1994; 136 pp.; In English

Report No.(s): AD-A414340; No Copyright; Avail: CASI; [A07](#), Hardcopy

There is continuing concern about the depletion of the ozone layer. Recently it has been determined that effluents from rockets exhausts contain chemical species that can be classified as Potentially Ozone Reactive Chemicals (PORCs). Calculations on the destruction of ozone layer suggest that that rockets contribute about 1% to the overall depletion on a yearly basis. This has motivated studies to determine methods and processes which can reduce the amount of ozone depletion. This study examines the use of alternate propellants to reduce the production of PORCs. The methodology is straightforward. The composition of a current solid rocket is examined and those chemical species which are classified as PORCs are identified. Alternate propellants are identified which reduce or eliminate the production of those PORCs. Not surprisingly, some of the exhaust species produced by the alternate propellants are classified as PORCs. The amounts of the species are quantified and found to be acceptably small. The technology status of these propellants and the rocket engines that would utilize them is briefly summarized. The safety, handling and toxicity characteristics of alternate propellants are presented.

DTIC

Ozone Depletion; Propellants; Stratosphere; Reactivity

20030067465 Massachusetts Inst. of Tech., Cambridge, MA

Heterogeneous Chemistry on Metal Oxide Surfaces of Interest for the Stratospheric Effects of Solid Rocket Motor Exhaust

Spencer, D. D.; Meads, R.; Molina, L. T.; Molina, M. J.; Dec. 1995; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A414330; No Copyright; Avail: CASI; [A03](#), Hardcopy

The emissions from solid rocket motors (SRMs) include hydrogen chloride vapor (HCl) and other inorganic chlorine compounds, as well as aluminum oxide particles. The effects of these emissions on stratospheric ozone have been investigated by Prather et al., Pyle, and others. Even though such effects are not evident from satellite observations following a Space Shuttle launch, it is possible for the perturbation to be quite pronounced in the immediate neighborhood of the rocket plume.

DTIC

Stratosphere; Solid Propellant Rocket Engines; Rocket Exhaust; Ozone Depletion; Metal Oxides; Exhaust Gases; Plumes

20030067486 Massachusetts Inst. of Tech., Cambridge, MA

Frontier Geoplasma Research

Chang, Tom T.; May 2003; 92 pp.; In English

Contract(s)/Grant(s): F485290-00-1-0004

Report No.(s): AD-A414351; AFRL-SR-AR-TR-03-0192; No Copyright; Avail: CASI; [A05](#), Hardcopy

The Center for Theoretical Geo/Cosmo Plasma Physics was established by the Air Force Office of Scientific Research in 1986 through a DoD University Research Initiative (URI) Grant via keen national competition. The goal of the center since its inception has been to develop and maintain a program of excellence in interdisciplinary space plasma research involving the mutual interactions of collaborating members of a select group of space scientists, plasma physicists, mathematicians and numerical analysts. During the past several years, under the grant title, 'Frontier Geoplasma Research', members of the center have made seminal contributions to a number of definitive research findings related to the phenomena of intermittent plasma turbulence, forced and/ or self-organized criticality, global acceleration of the solar wind and polar wind, sporadic localized reconnections in the magnetotail and in the auroral zone, charged particle energization through wave-particle interactions, the black aurora I curls, multi-scale evolutions, magnetosphere/ionosphere coupling, and the theory of complexity in space plasmas. Some of the results of these research activities have already found practical applications toward the missions of the USA Air Force, primarily through the collaborating efforts between the center members and members of the research group headed by Dr. J. R. Jasperse at the Air Force Research Laboratory.

DTIC

Plasma Physics; Research And Development; Geophysics; Plasmasphere

20030067525

Surface Layer Stability Transition Research Minimum Neutral Event-to-Sunrise Time Interval: 2001 September Case Study

Vaucher, Gail-Tirrel; Bustillos, Manny; May 2003; 67 pp.; In English

Report No.(s): AD-A414335; ARL-TR-2827; No Copyright; Avail: CASI; [A04](#), Hardcopy

Near surface target acquisition and EO propagation significantly improve during the Surface Layer Stability Transition (SLST). Thus, this research expands Army Chief of Staff Shinseki's vision from 'to see first' to, 'to see better'. The SLST is also the starting and ending points for the atmospheric convection growth phase, an important factor in chemical warfare modeling. In 2001, the Meteorological-sensors Integration Team of the Army Research Laboratory conducted the last of three field experiments with the primary purpose of characterizing, modeling and exploiting repeatable patterns in the lower portion of the atmospheric boundary layer. The repeatable patterns investigated were the morning Stability Transitions (ST) or Neutral Events (NE). The 2001 September 19-21 test dates were selected based on a forecasted minimal time interval between the local Sunrise and an Ideal case NE Two previous field tests addressed the other minimum (March 2001) and a maximum (June 2001) Sunrise-to-NE time interval These Tests are documented separate. This Surface Layer Stability Transition research pursued two measurement and analysis methods: Eulerian (Tower Data) and quasi-Lagrangian (Rawinsonde data) The Experiment's results validated the Neutral Event Forecast Model, in that all three days showed a ST during the forecasted ST time period. Examples of extended and multiple STs were documented by the data, further enhancing the characterization of a desert stable-neutral-unstable morning transition over the Equinox time period. The information documented in this report serves a useful building block in support of the primary goal.

DTIC

Periodic Variations; Optical Properties; Atmospheric Boundary Layer; Earth Atmosphere

20030067609 Iowa Univ., Iowa City, IA, USA

Transverse Dimensions of Chorus in the Source Region

Santolik, O.; Gurnett, D. A.; Geophysical Research Letters; 2003; ISSN 0094-8276; Volume 30, No. 2, pp. 3-1 - 3-4; In English

Contract(s)/Grant(s): NAG5-9974; ME-467; MSM-113200004; GACR-205/02/0947; Copyright; Avail: Other Sources

We report measurement of whistler-mode chorus by the four Cluster spacecraft at close separations. We focus our analysis on the generation region close to the magnetic equatorial plane at a radial distance of 4.4 Earth's radii. We use both linear and rank correlation analysis to define perpendicular dimensions of the sources of chorus elements below one half of the electron cyclotron frequency. Correlation is significant throughout the range of separation distances of 60-260 km parallel to the field line and 7-100 km in the perpendicular plane. At these scales, the correlation coefficient is independent for parallel separations, and decreases with perpendicular separation. The observations are consistent with a statistical model of the source region assuming individual sources as gaussian peaks of radiated power with a common half-width of 35 km perpendicular to the magnetic field. This characteristic scale is comparable to the wavelength of observed waves.

Author

Mathematical Models; Geophysics; Radii; Earth Magnetosphere; Cluster Mission; Dawn Chorus

47

METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20030066247 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA

Evaluation of the Mountain Wave Forecast Model's Stratospheric Turbulence Simulations

Allen, Mark S.; Mar. 2003; 81 pp.; In English; Original contains color illustrations

Report No.(s): AD-A413822; AFIT/GM/ENP/03-01; No Copyright; Avail: CASI; [A05](#), Hardcopy

Stratospheric turbulence (Stratoturb) is a well-known hazard to aircraft in flight. Forecasting mountain waves, specifically the breaking of these waves, is necessary to accurately predict the presence of Stratoturb. The Air Force Weather Agency (AFWA) requested a product with the capability of forecasting Stratoturb at 30, 50, and 70 mb using model data currently available. To facilitate their request, the Mountain Wave Forecast Model (MWFM) was acquired from the Naval Research Laboratory. MWFM turbulence forecasts generated twice daily over East Asia, using the AVN and MM5 models for initialization, were compared to S' layer turbulence analyses from the Rawinsonde Observation (RAOB) program, currently used operationally to warn aircrews. Actual verification of the MWFM forecasts was unachievable since in situ turbulence observations were not available, and as a result only subjective assessments of the MWFM's capabilities were possible. The MWFM was determined to be the superior forecast tool based on the temporal and spatial coverage provided when compared to RAOB as well as its promising ability to alleviate the reported overforecasting inherent to the RAOB analyses. Therefore, the MWFM, including code modifications made at AFIT, was recommended for use by AFWA. Further objective analysis of the model's accuracy should be conducted.

DTIC

Mountains; Stratosphere; Weather Forecasting; Turbulence; Mathematical Models

20030066307 NASA Marshall Space Flight Center, Huntsville, AL, USA

Interannual Variability of the Tropical Water Cycle: Capabilities in the TRMM Era and Challenges for GPM

Robertson, Franklin R.; [2003]; 1 pp.; In English; International Union of Geodesy and Geophysics, 30 Jun. - 11 Jul. 2003, Sapporo, Japan; No Copyright; Avail: Other Sources; Abstract Only

Considerable uncertainty surrounds the issue of whether precipitation over the tropical oceans (30' NE) systematically changes with interannual sea-surface temperature (SST) anomalies that accompany El Nino (warm) and La Nina (cold) events. Although it is well documented that El Nino-Southern Oscillation (ENSO) events with marked SST changes over the tropical oceans, produce significant regional changes in precipitation, water vapor, and radiative fluxes in the tropics, we still cannot yet adequately quantify the associated net integrated changes to water and heat balance over the entire tropical oceanic or land sectors. Robertson et al., [2001 GRL] for example, showed that substantial disagreement exists among contemporary satellite estimates of interannual variations in tropical rainfall that are associated with SST changes. Berg et al., [2002 J. Climate] have documented the distinct differences between precipitation structure over the eastern and western Pacific ITCZ and noted how various satellite precipitation algorithms may respond quite differently to ENSO modulations of these precipitation regimes. Resolving this uncertainty is important since precipitation and latent heat release variations over land and ocean sectors are key components of the tropical heat balance in its most aggregated form. Rainfall estimates from the Tropical Rainfall Measuring Mission (TRMM) Precipitation Radar (PR) averaged over the tropical oceans have not solved this issue and, in fact, show marked differences with estimates from two TRMM Microwave Imager (TMI) passive microwave algorithms. In this paper we will focus on findings that uncertainties in microphysical assumptions necessitated by the single-frequency PR measurement pose difficulties for detecting climate-related precipitation signals. Recent work has shown that path-integrated

attenuation derived from the effects of precipitation on the radar return from the ocean surface exhibits interannual variability that agrees closely with the TMI time series, yet the PR rainfall interannual variability (and attenuation derived predominantly from reflectivity) differs even in sign. We will explore these apparent inconsistencies and detail their impact on estimates of how ENSO events perturb the tropical rainfall. We will place these results in perspective by considering requirements for precipitation accuracy for global climate variability and change studies involving ENSO, monsoon dynamics and variations, and climate model improvement and validation. The discussion will conclude with an assessment of the implications of these findings for Global Precipitation Mission (GPM) requirements.

Author

Annual Variations; Climate Change; Climatology; Microwave Imagery; Time Series Analysis; Water Balance

20030066544 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Modeling Near-Surface Temperatures at Martian Landing Sites

Martin, T. Z.; Bridges, N. T.; Murphy, J. R.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

We have developed a process for deriving near-surface (approx. 1m) temperatures for potential landing sites, based on observational parameters from MGS TES, Odyssey THEMIS, and a boundary layer model developed by Murphy for fitting Pathfinder meteorological measurements. Minimum nighttime temperatures at the MER landing sites can limit power available, and thus mission lifetime. Temperatures are derived based on thermal inertia, albedo, and opacity estimated for the Hematite site in Sinus Meridiani, using predictions of 1-m air temperatures from a one-dimensional atmospheric model. The Hematite site shows 9 % probability of landing at a location with nighttime temperatures below the 97 C value considered to be a practical limit for operations.

Derived from text

Mathematical Models; Temperature; Mars Surface; Landing Sites; Atmospheric Models

20030066552 Washington Univ., Seattle, WA, USA

Great Martian Dust Storm Precursor?

Tillman, J. E.; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Reviews of rejected proposals for analyses of Viking lander meteorology data sometimes have stated that nothing significant remains to be learned: it is proposed that lander temperature differences between the first and second year prior to the dust storm season, may be related to or even be used as a predictor of whether or not great dust storms form later in the year. The Viking lander mission demonstrated conclusively that some years have great dust storms while others do not, contrary to conventional wisdom prior to the Viking results which suggested that they occurred every year. The first year had two, beginning at about L_s 210 (1977 A) and 310 (1977 B), the second and third had none, while the fourth year had one that was initiated about L_s 200 (1982).

Derived from text

Dust Storms; Mars Surface; Meteorology

20030066604 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

From the South Pole to the Northern Plains: The Argyre Planitia Story

Parker, T. J.; Grant, J. A.; Anderson, F. S.; Banerdt, W. B.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Parker (1985, 1994) first described evidence for catastrophic flooding from a large lake or sea within Argyre Planitia through the Uzboi-Holden- Ladon-Margaritifer Valles system during the Noachian. The channel connection to Argyre had been recognized during the mid-1970s, based primarily on Russian orbiter images taken at that time. The most critical reviews of these inferences related to the relative timing of the plains materials, sinuous ridges, and debris aprons in southern Argyre, and the connection, via Uzboi Vallis, of ponding within Argyre to flooding through the Chryse Trough. The prevailing 'competing' hypothesis for formation of materials within Argyre is that they are a result of south circumpolar glacial processes, with glacial scour and stagnation producing the pitting and sinuous ridges (eskers) on the basin floor rather than lacustrine erosion and deposition followed much later by a process akin to rock glacier formation of the debris aprons in a colder Amazonian climate. Argyre was part of a larger surface hydrological system that also included two large valley networks

draining the Margaritifer Sinus region northwest of Argyre. The morphometry of these systems suggest a combination of precipitation and groundwater sapping, with surface runoff for their formation.

Derived from text

Climate; Deposition; Ground Water; Erosion

20030066607 Kyoto Univ., Japan

Synoptic Seasonal Structure Evolution of the Low-Latitude Cloud Belt

Nakakushi, T.; Akabane, T.; Iwasaki, K.; Larson, S. M.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Recently, the importance of the role of water vapor and/or ice clouds has been recently emphasized, though their activities had not been examined in the post-Viking years. Among them, the most important substances are the polar caps and the low-latitude cloud belt which appears in northern summer. It has been widely accepted that this cloud belt should be coupled with the ascending branch of the 'cross-equatorial Hadley circulation' which forms in the solstitial seasons. A revolutionary development of observation techniques/devices (including spacecraft) in the latter half of the 20th century allowed us to examine the appearance and activated behavior of the cloud belt. Few of the observational reports, however, have discussed its dissipating behavior, and our knowledge about it has come mostly from theoretical methods. The paucity of reports on this issue prompted us to investigate it based on observations. By combining this dissipating behavior with the previously known developing/mature state, this study attempts to give an entire story of the cloud belt, and of the Martian climate.

Derived from text

Climate; Water Vapor; Ice Clouds; Mars Environment

20030066608 NASA Ames Research Center, Moffett Field, CA, USA

Multiyear Simulations of the Martian Water Cycle with the Ames General Circulation Model

Haberle, R. M.; Schaeffer, J. R.; Nelli, S. M.; Murphy, J. R.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color illustrations

Contract(s)/Grant(s): NAG5-1213; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Mars atmosphere is carbon dioxide dominated with non-negligible amounts of water vapor and suspended dust particles. The atmospheric dust plays an important role in the heating and cooling of the planet through absorption and emission of radiation. Small dust particles can potentially be carried to great altitudes and affect the temperatures there. Water vapor condensing onto the dust grains can affect the radiative properties of both, as well as their vertical extent. The condensation of water onto a dust grain will change the grain's fall speed and diminish the possibility of dust obtaining high altitudes. In this capacity, water becomes a controlling agent with regard to the vertical distribution of dust. Similarly, the atmosphere's water vapor holding capacity is affected by the amount of dust in the atmosphere. Dust is an excellent green house catalyst; it raises the temperature of the atmosphere, and thus, its water vapor holding capacity. There is, therefore, a potentially significant interplay between the Martian dust and water cycles. Previous research done using global, 3-D computer modeling to better understand the Martian atmosphere treat the dust and the water cycles as two separate and independent processes. The existing Ames numerical model will be employed to simulate the relationship between the Martian dust and water cycles by actually coupling the two cycles. Water will condense onto the dust, allowing the particle's radiative characteristics, fall speeds, and as a result, their vertical distribution to change. Data obtained from the Viking, Mars Pathfinder, and especially the Mars Global Surveyor missions will be used to determine the accuracy of the model results.

Derived from text

Mars Surface; Water Vapor; Computerized Simulation; Atmospheric General Circulation Models; Atmospheric Models; Three Dimensional Models; Hydrological Cycle

20030066609 California Inst. of Tech., Pasadena, CA, USA

Preliminary South Polar History from Layered Deposit Landforms

Murray, B. C.; Koutnik, M.; Byrne, S.; Marsden, P.; Schaller, E.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Polar Layered Deposits long have been believed to be dominantly ice-rich deposits incorporating a variable amount of aeolian dust accumulated in response to quasi-periodic climate fluctuations. There had been great anticipation for unraveling

a detailed stratigraphic and associated climate record from the now abundant high resolution MGS MOC and MOLA data. Such elucidation has proven more difficult to realize than expected, because of numerous vertical breaks in the record due to deformation and unconformities, and perhaps also more abundant along-strike variations in layer properties than expected. Furthermore, profound differences between the northern and southern layered deposits are highlighted by these abundant high-resolution data, making it increasingly difficult to postulate any simple common global climate process driven by obliquity variations for their origin. Pre-MGS suggestions that the northern deposits are younger than the southern have been confirmed and seemingly rule out any hemispheric climatic alternation process that would fit within the maximum periodicity of the obliquity cycle, chaotic or deterministic. Equally challenging to expectations of symmetry between the atmospheric forcing process that produced the north and south polar deposits is the discovery of a 300-500 meter basal sand unit underlying the north polar layered deposits. This surprising depositional relationship implies ice deposition did not occur in the north during many 10s of million of years while it was taking place at the south. No postulated fluctuation in orbital elements, of which we are aware, is a plausible cause of such a sustained difference in north vs. south polar environments. In contrast to the approach used sometimes to studying layering within terrestrial deep-sea cores by presuming a Milankovitch signal is discernibly encoded in the stratigraphy, on Mars we lack the confident knowledge of strong enough astronomical signals impressed uniformly within the depositional record to assure correlation, although it is likely that portions of that Martian signal are widely, but variably, present within the polar layered deposits.

Derived from text

Polar Meteorology; Deposits; Landforms; Ice; Climate

20030066618 State Univ. of New York, Stony Brook, NY, USA

Magmas Parental to the Chassigny Meteorite: New Considerations

Nekvasil, H.; Filiberto, J.; Whitaker, M.; Lindsley, D. H.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Comparisons with plume-associated magmas on Earth suggest major similarities between the Chassigny mineral assemblages and those that fractionate along the hy(hypersthene)-normative sodic alkalic trend exemplified by lavas from certain ocean island, continental hotspot and continental rift regimes. Plume-associated magmas on Earth are characterized by extreme diversity of associated rocks, with rocks ranging from alkali basalt, olivine tholeiite, and biotite gabbro to anorthosite, syenite, comendite, pantellerite, phonolite and potassic granite, and spanning the spectrum from silica-undersaturated to silicaoversaturated units, including peralkaline types. However, viewed globally, plume-associated magmatic suites, as defined by spatially and temporally associated rock units, fall into distinct patterns. These patterns emerge as four major trends.

Derived from text

Magma; Meteorites; Analogies; Anorthosite; Lava; Mineral Deposits

20030066620 NASA Johnson Space Center, Houston, TX, USA

Evidence for Mars Regolith Preserved in Shergottite EET79001: Differential Comminution and Chemical Weathering Records

Rao, M. N.; McKay, D. S.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Earlier, we pointed out that some shergottite impact melt glasses contain large abundances of Martian atmospheric noble gases and show large variations in Sr-87/Sr-86 (initial) isotopic ratios. These samples likely contain Martian regolith fines (MRF). We showed that one of the characteristics of these MSF fractions is the simultaneous enrichment of felsic component and an associated depletion of the mafic component relative to the host phase in which these glasses are located. In several samples studied by us, the magnitude of enrichment and depletion is found to vary from one sample to the other. In addition, these samples show evidence for the occurrence of secondary sulfate mineral phases due to aqueous alteration near Mars surface. As the basaltic shergottites presumably originate from near-surface regions of young volcanic terrains such as Tharisis (Olympus Mons) or Elysium Mons, the MSF fraction embedded in these impact glasses likely provide clues regarding the physical and chemical weathering environment to which their precursor soils were exposed near the Martian uplands prior to the impact-melt generation. We suggested earlier that the felsic enrichment and mafic depletion observed in these samples is related to the occurrence of the Martian regolith fine fraction in them. These glasses contain varying amounts of the MRF fraction and the relative ratios of the coarse and fine fractions in these impact glasses determine the magnitude of the enrichment and depletion factors in these samples. On comparison of our results with those obtained in the laboratory simulation bombardment experiments on gabbro using projectiles with similar impact velocities on Moon/Mars by Horz et al.,

we found that, though the patterns of enrichment and depletion of the element-oxides in the samples are similar, but their magnitudes are grossly different. In the Horz et al. experiments, the finer size fractions were enriched in Al_2O_3 relative to the starting composition and were depleted in FeO and MgO. If we assume that melt glass pocket, 507 originally consisted entirely of fine-grained regolith developed on the host rock represented by EET79001 (lithology B), can we explain the difference in chemistry entirely by differential comminution and mechanical concentration of the fines? When we compare the melt glass composition in EET79001 to the bulk rock composition, we find the same trends shown by Horz et al., but they are much more enhanced. If the regolith material which was the precursor to the melt glass originally consisted of fine-grained regolith, differential comminution concentration of the fines by mechanical fractionation could explain the trends, but not the magnitude of the chemical difference. Consequently we conclude that, while differential comminution and mechanical fractionation may have operated, there must be other processes operating on Mars responsible for the significant difference in composition between the melt glass and the bulk rock. In this study, we examine this aspect in detail and show that these differences could be explained by chemical (acid-sulfate) weathering of the soil fines near the martian surface by aqueous solutions containing acidic volatiles such as SO_2 and H_2O released in volcanic eruptions during the last few hundred million years on Mars.

Derived from text

Regolith; Mars Surface; Mars Atmosphere; Mineralogy; Melts (Crystal Growth); Shergottites; Weathering

20030066746 Arizona State Univ., Tempe, AZ, USA

Temporal Invariance of Wind Orientations as Recorded by Aeolian Features in Proctor Crater

Fenton, L. K.; Richardson, M. I.; Toigo, A. D.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The importance of wind action among contemporary surface processes on Mars has become well known since the first dunes were observed in spacecraft images. Wind circulation patterns determine the location and magnitude of sources, sinks, and transport pathways of particulate materials. The winds also dictate the morphology of aeolian features, such as yardangs and dunes. Because of this coupling between surface materials and the atmosphere, the study of one is not complete without the study of the other. With the advent of mesoscale atmospheric models, the circulation of a small region can be examined in detail for the first time. These models can be used in concert with spacecraft data, and in particular MOC NA (Mars Orbiter Camera Narrow Angle) images, which provide detailed wind orientations at the scale of tens of meters. Comparing the two provides not only a verification of the mesoscale model and the GCM to which it is coupled, but also an understanding of the source of the winds that influence the surface. This in turn can lead to a better understanding of landscape morphology and the sources and sinks of mobile material. In this work, we apply the Mars Mesoscale Model 5 (Mars MM5) to Proctor Crater to determine how the observed aeolian features correlate with predicted wind orientations. The various aeolian features on the crater floor have different relative ages, such that the comparison of each type of feature with the current wind regime provides an understanding of how wind circulation patterns have changed since the oldest remaining aeolian features formed.

Derived from text

Wind Direction; Atmospheric Circulation; Mars Craters; Mesometeorology

20030066778 NASA Ames Research Center, Moffett Field, CA, USA

Water-Ice Clouds in the LMDs Martian General Circulation Model

Montmessin, F.; Forget, F.; Haberle, R. M.; Rannou, P.; Cabane, M.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The interest for Martian water ice clouds has recently taken a new extent given their likely involvement both in climate and in the hydrological cycle. Previous related microphysical studies have already discussed the complex interactions between airborne dust and clouds [2]. Whereas water ice mantles upon dust cores enhance sedimentation rates and thus possibly change the vertical distribution of dust and water, the advection of clouds by winds could also modulate the geographical distribution of volatiles. Within this context, only 3D modeling based on the use of Martian General Circulation Models (MGCM) is able to give us a consistent clue of the global climatic aspects of Martian clouds.

Derived from text

Atmospheric General Circulation Models; Ice; Water; Mars Atmosphere; Ice Clouds

20030066797 NASA Ames Research Center, Moffett Field, CA, USA

Numerical Simulations of the Evolution of the CO₂ Atmosphere of Mars: 4.53 Ga to the Present

Manning, C. V.; McKay, C. P.; Zahnle, K. J.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

In this paper we approach four key questions that are central to our understanding of the nature of climate change on Mars: 1. By what mechanism has the evolution of the CO₂ atmosphere, dominated at early times by violent process, been guided to the moderate quantities present today? 2. How do obliquity cycles affect the migration of CO₂ between the various reservoirs of CO₂, and what effect does this have on the bulk atmosphere of the planet in time? 3. Is the geophysical evidence that the last few Myr experienced periods that are substantially wetter than the present attributable to a substantially more massive greenhouse atmosphere? 4. Is the current atmospheric pressure determined primarily by the partial pressure of CO₂ in cold (approx. 148 K) ice caps, or is it because disequilibrium water, and hence weathering, ceases at pressures below the triple point of water?

Derived from text

Numerical Analysis; Evolution (Development); Carbon Dioxide; Mars Atmosphere; Greenhouse Effect

20030067057 Alfred-Wegener-Inst. for Polar Research, Potsdam, Germany

Reports of Discovery of the 'Eltanin Crater' are Contradicted by Data

Gersonde, Rainer; Kyle, Frank T.; Bleil, U.; Kuhn, Gerhard; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Deposits of the Eltanin impact event were first discovered as an Ir anomaly in deep-sea sediments of late Pliocene age deposited in the South-East Pacific Ocean. These were found to contain coarse ejecta composed of an Ir-rich melt rock derived directly from the impacting asteroid, and several percent unmelted meteorites, since named the Eltanin meteorite. A 1995 RV Polarstern expedition to the suspected impact region found that sediments in the region around the Freeden Seamounts (57.3 S 90.5 W; we previously called these the San Martin Seamounts, but they were officially named Freeden in 1999) contained high concentrations of meteoritic ejecta typically =1 g/cm². They also found that sediments in this region had been severely disrupted by the impact, which ripped-up and redeposited sediments as old as Eocene in age.

Derived from text

Anomalies; Asteroids; Craters

48

OCEANOGRAPHY

Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics; and marine resources. For related information see also *43 Earth Resources and Remote Sensing*.

20030066583 Massachusetts Univ., Amherst, MA, USA

Evaluating Putative Shoreline Adjacent to the Dichotomy Boundary near Arabia Terra

Webb, Valerie E.; McGill, George E.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

In 1989, Parker et al. identified two geologic contacts, Contact #1 and Contact #2, which they believed demarcated two distinct highstands of a global ocean ponded within the northern lowlands. Since then, Clifford and Parker presented new nomenclature for Contact #1 and Contact #2, now known as the Arabia and Deuteronilus trends, respectively. To date, a total of nine putative shorelines have been identified by Parker et al., who categorized both global and regional scale trends. Our approx. 400,000 sq km study area is just north of Arabia Terra, contiguous to the dichotomy boundary and centered on Cydonia Mensae. It is significant in further testing the shoreline hypothesis because it contains both the global scale trends Arabia and Deuteronilus, along with a regional trend known as Acidalia.

Derived from text

Evaluation; Shorelines; Dichotomies

20030067260 Naval Research Lab., Washington, DC

Depth Profile of Bacterial Metabolism and PAH Biodegradation in Bioturbated and Unbioturbated Marine Sediments

Montgomery, Michael T.; Osburn, Christopher L.; Apr. 25, 2003; 21 pp.; In English

Contract(s)/Grant(s): N0001499WX20525

Report No.(s): AD-A413677; NRL/FR/6114-03-10; 057; No Copyright; Avail: CASI; [A03](#), Hardcopy

Bacterial mineralization of polycyclic aromatic hydrocarbons (PAH) to carbon dioxide is known to occur most rapidly in highly aerated microenvironments. Bioturbation of marine sediments by benthic microfauna has the potential to increase both rate and depth of bacterial PAH mineralization by recirculating oxygenated bottom water into sediment burrows. We measured heterotrophic bacterial production and mineralization of PAHs in sections of sediment cores sampled from two stations in an urbanized waterway feeding San Diego Bay. Heterotrophic bacterial production was twofold higher in cores with greater bioturbation depth and was much higher in the top 2 cm of both cores. PAH mineralization was higher in the top 12 cm of the core from the bioturbated station (P04) relative to the less bioturbated station (P17). The depth of bioturbation by the benthic macrofaunal and meiofaunal assemblage may be an important factor in selecting for PAH-degrading bacterial assemblages in impacted sediment. This synergistic relationship may be an important determinant in the natural recovery rate of hydrocarbon-impacted marine sediments.

DTIC

Bacteria; Metabolism; Polycyclic Aromatic Hydrocarbons; Biodegradation; Sediments; Ocean Bottom

51

LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance of animals and plants in space and related environmental conditions. For specific topics in life sciences see *categories 52 through 55*.

20030067380 NASA Marshall Space Flight Center, Huntsville, AL, USA

Neuregulin: First Steps Towards a Structure

Ferree, D. S.; Malone, C. C.; Karr, L. J.; [2003]; 1 pp.; In English; American Crystallographic Association Conference, 26-31 Jul. 2003, Covington, KY, USA; No Copyright; Avail: CASI; [A01](#), Hardcopy

Neuregulins are growth factor domain proteins with diverse bioactivities, such as cell proliferation, receptor binding, and differentiation. Neuregulin-1 binds to two members of the ErbB class I tyrosine kinase receptors, ErbB3 and ErbB4. A number of human cancers overexpress the ErbB receptors, and neuregulin can modulate the growth of certain cancer types. Neuregulin-1 has been shown to promote the migration of invasive gliomas of the central nervous system. Neuregulin has also been implicated in schizophrenia, multiple sclerosis and abortive cardiac abnormalities. The full function of neuregulin-1 is not known. In this study we are inserting a cDNA clone obtained from American Type Culture Collection into E.coli expression vectors to express neuregulin-1 protein. Metal chelate affinity chromatography is used for recombinant protein purification. Crystallization screening will proceed for X-ray diffraction studies following expression, optimization, and protein purification. In spite of medical and scholarly interest in the neuregulins, there are currently no high-resolution structures available for these proteins. Here we present the first steps toward attaining a high-resolution structure of neuregulin-1, which will help enable us to better understand its function

Author

Proteins; X Ray Diffraction; Chromatography

20030067447 Research Triangle Inst., Research Triangle Park, NC, USA

The Developmental Toxicity Evaluation for Goldenseal Root Powder ('Hydrastis canadensis') Administered in the Feed to Sprague-Dawley (CD (Trade Name)) Rats on Gestational Days 6 to 20

Price, C. J.; Apr. 03, 2003; 130 pp.; In English

Report No.(s): PB2003-105482; RTI-683; No Copyright; Avail: CASI; [A07](#), Hardcopy

Goldenseal (*Hydrastis canadensis*) root powder is readily available in over-the-counter (OTC) dietary supplements. Thus, the potential hazards of oral exposure during pregnancy warranted further investigation. The present study was designed to evaluate potential developmental toxicity in timed-mated rats exposed to goldenseal root powder in the diet throughout the embryo/fetal period. In this study, time-mated Sprague-Dawley rats were given ad libitum access to NIH-07 ground feed containing goldenseal root powder (0, 3125, 6250, 12500, or 18400 ppm) from gestational day (gd) 6 to 20. Calculated intake of goldenseal root powder was 0, 207, 415, 841, and 1215 mg/kg/day For the control through high-dose groups, respectively.

Goldenseal root powder contained 5% berberbine and 4.5% hydrastine by weights. Thus, ingested doses of these constituents were 0, 9, 19, 38 and 55 mg hydrastine/kg.day.

NTIS

Toxicity; Reproduction (Biology); Evaluation; Mice; Diets; Dosage

20030067448 Research Triangle Inst., Research Triangle Park, NC, USA

Laboratory Supplement for the Final Study Report on the Developmental Toxicity Evaluation for Goldenseal Root Powder ('Hydrastis canadensis') Administered in the Feed to Sprague-Dawley (CD (Trade Name)) Rats on Gestational Days 6 to 20

Price, C. J.; Apr. 03, 2003; 492 pp.; In English

Report No.(s): PB2003-105483; RTI-683; No Copyright; Avail: CASI; [A21](#), Hardcopy

Goldenseal (*Hydrastis canadensis*) root powder is readily available in over-the-counter (OTC) dietary supplements. Thus, the potential hazards of oral exposure during pregnancy warranted further investigation. The present study was designed to evaluate potential developmental toxicity in timed-mated rats exposed to goldenseal root powder in the diet throughout the embryo/fetal period. In this study, time-mated Sprague-Dawley rats were given ad libitum access to NIH-07 ground feed containing goldenseal root powder (0, 3125, 6250, 12500, or 18400 ppm) from gestational day (gd) 6 to 20. Calculated intake of goldenseal root powder was 0, 207, 415, 841, and 1215 mg/kg/day For the control through high-dose groups, respectively. Goldenseal root powder contained 5% berberbine and 4.5% hydrastine by weights. Thus, ingested doses of these constituents were 0, 9, 19, 38 and 55 mg hydrastine/kg.day.

NTIS

Reproduction (Biology); Toxicity; Exposure; Hazards

52

AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments, see *53 Behavioral Sciences*. For the effects of space on animals and plants see *51 Life Sciences*.

20030066855 Defence Science and Technology Organisation, Edinburgh, Australia

Minimizing Side Effects of Virtual Environments

Barrett, Judy; February 2003; 22 pp.; In English

Report No.(s): DSTO-TN-0478; DODA-AR-012-563; Copyright; Avail: Other Sources

For some individuals participation in virtual environments (VEs) can result in side effects, including symptoms of nausea, disorientation, postural instability or eyestrain. The incidence and severity of symptoms are influenced by a number of factors related to the design of the VE, the task being performed, and the susceptibility of the participant. Thus taking these factors into account when designing the VE and tasks, and specifying what is required of participants, can reduce side effects. This report lists the relevant factors, and makes general recommendations to ensure that side effects in VEs are avoided or minimized. Particular consideration is given to the wide screen display of the Future Operations Centre Analysis Laboratory (FOCAL), where factors needing empirical investigation are identified.

Author

Virtual Reality; Human Factors Engineering; Biological Effects; Signs And Symptoms; Psychophysiology

54

MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human factors engineering, bionics, man-machine systems, life support, space suits and protective clothing. For related information see also *16 Space Transportation and Safety* and *52 Aerospace Medicine*.

20030066257 Universal Energy Systems, Inc., Dayton, OH, USA

Contributive Research in Aviation Medicine, Bioengineering, Human Performance Analytic and Modeling Systems

Harding, Thomas H.; Dec. 2002; 302 pp.; In English

Contract(s)/Grant(s): DAMD17-95-C-5095

Report No.(s): AD-A414143; No Copyright; Avail: CASI; [A14](#), Hardcopy

The U.S. Army Aeromedical Research Laboratory (USAARL) at Fort Rucker, Alabama, is tasked with a broad range of applied research and engineering programs designed to answer biomedical questions dealing with aviator and soldier performance issues in an operational environment. In carrying out its mission, the Laboratory encounters unique and complex research requirements that demand maximum flexibility in its response capability. In order to achieve such flexibility, UES, Inc. was contracted to provide engineering and scientific research support in the areas of aviation medicine; biological and human factors engineering; crash modeling and research on airbags, restraint systems and head supported weight; aeromedical equipment air worthiness evaluations; research on flat panel and advanced cockpit displays, evaluations of developmental optical systems, and visual performance with military displays; and biochemical support of research in pharmaceutical intervention in army air crew. This report provides a brief summary of the extensive work performed by UES engineers and scientists during this task order contract. This report covers work completed during a seven year, five month research effort.

DTIC

Human Factors Engineering; Bioengineering; Aerospace Medicine; Biochemistry

20030066343 Range Commanders Council, White Sands Missile Range, NM, USA

Common Risk Criteria for National Test Ranges: Inert Debris

Jun. 2002; 21 pp.; In English; Original contains color illustrations

Report No.(s): AD-A413022; RCC/RSG-STANDARD-321-02; No Copyright; Avail: CASI; [A03](#), Hardcopy

This document provides a common set of debris protection policies, risk criteria, and guidelines to protect personnel and assets during manned and unmanned flight operations. It establishes the following: 1) Maximum risk criteria for both the general public (involuntary acceptance) and mission essential personnel (voluntary acceptance). 2) Debris lethality criteria for unprotected and sheltered personnel. 3) Debris damage thresholds for aircraft and ships.

DTIC

Debris; Risk

20030066375 Umpqua Research Co., Myrtle Creek, OR, USA

Microgravity and Hypogravity Compatible Methods for the Destruction of Solid Wastes by Magnetically Assisted Gasification

Atwater, James E.; Akse, James R.; Wheeler, Richard R., Jr.; Jovanovic, Goran N.; Pinto-Espinoza, Joaquin; Reed, Brian; Sornchamni, Thana; August 2003; 144 pp.; In English

Contract(s)/Grant(s): NAG9-1181

Report No.(s): URC-81036; No Copyright; Avail: CASI; [A07](#), Hardcopy

This report summarizes a three-year collaborative effort between researchers at UMPQUA Research Company (URC) and the Chemical Engineering Department at Oregon State University (OSU). The Magnetically Assisted Gasification (MAG) concept was originally conceived as a microgravity and hypogravity compatible means for the decomposition of solid waste materials generated aboard spacecraft, lunar and planetary habitations, and for the recovery of potentially valuable resources. While a number of methods such as supercritical water oxidation (SCWO), fluidized bed incineration, pyrolysis, composting and related biological processes have been demonstrated for the decomposition of solid wastes, none of these methods are particularly well-suited for employment under microgravity or hypogravity conditions. For example, fluidized bed incineration relies upon a balance between drag forces which the flowing gas stream exerts upon the fluidization particles and the opposing force of gravity. In the absence of gravity, conventional fluidization cannot take place. Hypogravity operation can also be problematic for conventional fluidized bed reactors, because the various factors which govern fluidization phenomena do not all scale linearly with gravity. For this reason it may be difficult to design and test fluidized bed reactors in 1g, which are intended to operate under different gravitational conditions. However, fluidization can be achieved in microgravity (and hypogravity) if a suitable replacement force to counteract the forces between fluid and particles can be found. Possible alternatives include: centripetal force, electric fields, or magnetic fields. Of these, magnetic forces created by the action of magnetic fields and magnetic field gradients upon ferromagnetic media offer the most practical approach. The goal of this URC-OSU collaborative effort was to develop magnetic hardware and methods to control the degree of fluidization (or conversely consolidation) of granular ferromagnetic media and to employ these innovations in sequential filtration and fluidized bed processes for the segregation and decomposition of solid waste materials, and for the concentration and collection of inorganic residue (ash). This required the development of numerous enabling technologies and tools.

Author

Solid Wastes; Gasification; Microgravity

20030066920 NASA Johnson Space Center, Houston, TX, USA

Evaluation of Critical Care Monitor Technology During the US Navy Strong Angel Exercise

Johannesen, John; Rasbury, Jack; August 2003; 59 pp.; In English; Original contains black and white illustrations

Report No.(s): NASA/CR-2003-208937; S-911; NAS 1.26:208937; No Copyright; Avail: CASI; [A04](#), Hardcopy

The NASA critical path road map identifies 'trauma and acute medical problems' as a clinical capability risk category (<http://criticalDath.isc.nasa.gov>). Specific risks include major trauma, organ laceration or contusion, hemoperitoneum, pulmonary failure, pneumo- and hemothorax, burn, open bone fracture, blunt head trauma, and penetrating injury. Mitigation of these risks includes the capability for critical care monitoring. Currently, the International Space Station (ISS) Crew Health Care System (CHeCS) does not provide such a capability. The Clinical Space Medicine Strategic Planning Forum (4/8/97), sponsored by NASA Medical Operations, identified the development of trauma care capabilities as one of the top priorities for space medicine. The Clinical Care Capability Development Project (CCCDP) subsequently undertook the task to address this need.

Author

Clinical Medicine; Aerospace Medicine; Risk

20030067371 RAND Corp., Santa Monica, CA

Biometrics: A Look at Facial Recognition

Woodward, John D., Jr.; Horn, Christopher; Gatune, Julius; Thomas, Aryn; Jan. 2003; 10 pp.; In English

Report No.(s): AD-A414520; No Copyright; Avail: CASI; [A02](#), Hardcopy

During the 2002 General Assembly, Delegate H. Morgan Griffith sponsored legislation that would set legal parameters for public sector use of facial recognition technology in Virginia. The legislation, known as House Bill No. 454 (included as an Appendix), passed the House of Delegates by a vote of 74-25 earlier this year, and is pending in the Senate Courts of Justice Committee while the Virginia State Crime Commission examines it. The Virginia State Crime Commission, a standing legislative commission of the Virginia General Assembly, is statutorily mandated to make recommendations on all areas of public safety in the Commonwealth of Virginia. Currently, Virginia Beach is the only municipality in Virginia planning to incorporate facial recognition technology into its public safety efforts. Late last year, the Virginia Beach City Council approved a measure authorizing the installation of a facial recognition system in the city's 'Oceanfront' tourist area. The system has been tested and has recently been fully implemented. Senator Kenneth W. Stolle, the Chairman of the Virginia State Crime Commission, established a Facial Recognition Technology Sub-Committee to examine the issue of facial recognition technology. This briefing begins by defining biometrics and discussing examples of the technology. It then explains how biometrics may be used for authentication and surveillance purposes. Facial recognition is examined in depth to include technical, operational, and testing considerations. This briefing concludes with a discussion of the legal status quo with respect to public sector use of facial recognition. While not making a specific policy recommendation with respect to House Bill No. 454, this briefing hopefully provides useful information for Sub-Committee members, the Virginia State Crime Commission, and other interested parties.

DTIC

Biometrics; Computer Information Security; Congressional Reports

20030067504

Endurance Time in the Self-Contained Toxic Environment Protective Outfit (STEPO) with Personal Ice-Cooled Microclimate Cooling System (PICS) in Three Environments

Levine, Leslie; Cadarette, Bruce S.; Kolka, Margaret A.; May 2003; 39 pp.; In English

Report No.(s): AD-A414499; USARIEM-TR-T03-13; No Copyright; Avail: CASI; [A03](#), Hardcopy

This study of the Self-Contained Toxic Environment Protective Outfit (STEPO) with the Personal Ice-Cooled Microclimate Cooling System (PICS) in three environments was conducted in September 2002 at the request of Project Manager -Soldier Systems, Product Manager- Soldier Equipment (PM-Soldier), Ft. Belvoir, VA. PM-Soldier was addressing the needs of the STEPO/PICS users for guidance on work times up to 4 hours. A 1999 study of this STEPO/PICS system demonstrated that 4-hr work times were not safe for workers in a 38 deg C (100 deg F) environment. Using the same testing format of repeated cycles of 10 min rest and 20 min of treadmill walking, eliciting an overall moderate energy cost of 300-350 Watts, this study looked at the system in three less stressful environments: HOT 32.2 deg C (90 deg F) / 30% rh MODERATE 23.9 deg C (75 deg F) /40% rh, and COOL 15.6 deg C (60 deg F) / 50% rh, to ascertain endurance times in each of these environments.

DTIC

Cooling Systems; Protective Clothing; Microclimatology

55
EXO BIOLOGY

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see *52 Aerospace Medicine*; on animals and plants see *51 Life Sciences*. For psychological and behavioral effects of aerospace environments see *53 Behavioral Sciences*.

20030066240 Wake Forest Univ., Winston-Salem, NC, USA

Fucus as a Model System to Study the Role of Auxin Transport and the Actin Cytoskeleton in Gravity Response

Muday, Gloria K.; [2003]; 4 pp.; In English

Contract(s)/Grant(s): NAG2-1203; No Copyright; Avail: CASI; [A01](#), Hardcopy

The overarching goal of this proposal was to examine the mechanisms for the cellular asymmetry in auxin transport proteins. As auxin transport polarity changes in response to reorientation of algal and plant cells relative to the gravity vector, it was critical to ask how auxin transport polarity is established and how this transport polarity may change in response to gravity stimulation. The experiments conducted with this NASA grant fell into two categories. The first area of experimentation was to explore the biochemical interactions between an auxin transport protein and the actin cytoskeleton. These experiments used biochemical techniques, including actin affinity chromatography, to demonstrate that one auxin transport protein interacts with the actin cytoskeleton. The second line of experiments examined whether in the initially symmetrical single celled embryos of *Fucus distichus*, whether auxin regulates development and whether gravity is a cue to control the morphogenesis of these embryos and whether gravi-morphogenesis is auxin dependent. Results in these two areas are summarized separately below. As a result of this funding, in combination with results from other investigators, we have strong evidence for an important role for the actin cytoskeleton in both establishing and change auxin transport polarity. It is also clear that *Fucus distichus* embryos are auxin responsive and gravity controls their morphogenesis.

Author

Plants (Botany); Biochemistry; Gravitation; Asymmetry

20030066524 Texas Univ., Austin, TX, USA

Cellular Bases of Light-regulated Gravity Responses

Roux, Stanley J.; [2003]; 7 pp.; In English

Contract(s)/Grant(s): NAG2-1347; No Copyright; Avail: CASI; [A02](#), Hardcopy

This report summarizes the most significant research accomplished in our NAG2-1347 project on the cellular bases of light-regulated gravity responses. It elaborates mainly on our discovery of the role of calcium currents in gravity-directed polar development in single germinating spore cells of the fern *Ceratopteris*, our development of RNA silencing as a viable method of suppressing the expression of specific genes in *Ceratopteris*, and on the structure, expression and distribution of members of the annexin family in flowering plants, especially *Arabidopsis*.

Derived from text

Calcium; Plants (Botany); Gravitation; Genes

20030066593 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Hydrophobic Surfaces of Spacecraft Components Enhance the Aggregation of Microorganisms and May Lead to Higher Survival Rates on Mars

Schuerger, A. C.; Kern, R. G.; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

In order to minimize the forward contamination of Mars, spacecraft are assembled under clean-room conditions that often require several procedures to clean and sterilize components. Surface characteristics of spacecraft materials may contribute to microbial survival by protecting spores from sterilizing agents, including UV irradiation on the surface of Mars. The primary objective of this study was to evaluate the effects of surface characteristics of several spacecraft materials on the survival of *Bacillus subtilis* spores under simulated Martian conditions.

Derived from text

Hydrophobicity; Spacecraft Contamination; Bacillus; Mars Environment; Microorganisms

20030066724 NASA Johnson Space Center, Houston, TX, USA

Beagle 2: Seeking the Signatures of Life on Mars

Gibson, Everett K., Jr.; Pillinger, Colin T.; Wright, Ian P.; Morse, Andy; Stewart, Jenny; Morgan, G.; Praine, Ian; Leigh, Dennis; Sims, Mark R.; Pullan, Derek; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Beagle 2 is a 60 kg probe (with a 30 kg lander) developed in the UK for inclusion on the European Space Agency's 2003 Mars Express. Beagle 2 will deliver to the Martian surface a payload which consists of a high percentage of science instruments to landed spacecraft mass. Beagle 2 will be launched in June 2003 with Mars Express on a Soyuz-Fregat rocket from the Baikonur Cosmodrome in Kazakhstan. Beagle 2 will land on Mars in December 2003 in Isidis Planitia (approx. 11.5 deg.N and 275 deg.W), a large sedimentary basin that overlies the boundary between ancient highlands and northern plains. Isidis Planitia, the third largest basin on Mars, which is possibly filled with sediment deposited at the bottom of long-standing lakes or seas, offers an ideal environment for preserving traces of life. Beagle 2 is completed and undergoing integration with the Mars Express orbiter prior to launch.

Derived from text

Probes; Mars Surface; Extraterrestrial Life

20030066765 NASA Langley Research Center, Hampton, VA, USA

Non-Equilibrium Thermodynamic Chemistry and the Composition of the Atmosphere of Mars

Levine, J. S.; Summers, M. E.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

A high priority objective of the Mars Exploration Program is to Determine if life exists today (MEPAG Goal I, Objective A). The measurement of gases of biogenic origin may be an approach to detect the presence of microbial life on the surface or subsurface of Mars. Chemical thermodynamic calculations indicate that on both Earth and Mars, certain gases should exist in extremely low concentrations, if at all. Microbial metabolic activity is an important non-equilibrium chemistry process on Earth, and if microbial life exists on Mars, may be an important nonequilibrium chemistry process on Mars. The non-equilibrium chemistry of the atmosphere of Mars is discussed in this paper.

Derived from text

Mars Atmosphere; Mars Surface; Thermodynamics; Extraterrestrial Life

20030066911 Scripps Research Inst., La Jolla, CA, USA

The Effect of Cytidine on the Structure and Function of an RNA Ligase Ribozyme

Rogers, Jeff; Joyce, Gerald F.; RNA; [2001]; Volume 7, pp. 395-404; In English

Contract(s)/Grant(s): NAG5-3647; NAG5-4546; Copyright; Avail: Other Sources

A cytidine-free ribozyme with RNA ligase activity was obtained by in vitro evolution, starting from a pool of random-sequence RNAs that contained only guanosine, adenosine, and uridine. This ribozyme contains 74 nt and catalyzes formation of a 3',5' -phosphodiester linkage with a catalytic rate of 0.016/min. The RNA adopts a simple secondary structure based on a three-way junction motif, with ligation occurring at the end of a stem region located several nucleotides away from the junction. Cytidine was introduced to the cytidine-free ribozyme in a combinatorial fashion and additional rounds of in vitro evolution were carried out to allow the molecule to adapt to this added component. The resulting cytidine-containing ribozyme formed a 3',5' linkage with a catalytic rate of 0.32/min. The improved rate of the cytidine-containing ribozyme was the result of 12 mutations, including seven added cytidines, that remodeled the internal bulge loops located adjacent to the three-way junction and stabilized the peripheral stem regions.

Author

Ribonucleic Acids; Combinatorial Analysis; Enzyme Activity; In Vitro Methods And Tests; Adenosines; Guanosines

59

MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see *categories 60 through 67*.

20030066445 Technische Univ., Delft, Netherlands

Integer GPS-Ambiguity Estimation without the Receiver-Satellite Geometry

Jonkman, N. F.; February 1998; 114 pp.; In English

Report No.(s): PB2003-104788; LGR-18; Copyright; Avail: National Technical Information Service (NTIS)

Integer ambiguity estimation is a prerequisite for fast and very precise positioning with the Global Positioning System (GPS). In this report we will study the usefulness of a particular approach to integer ambiguity estimation, the so-called geometry-free approach. This approach consists of two steps: adjusting GPS-observations for the unknown ambiguities according to the geometry-free observation model and based on the resulting real valued ambiguity estimates and their precision description; and computing integer valued ambiguity estimates with the LAMBDA-method.

NTIS

Global Positioning System; Ambiguity

20030067155

Final Report for LDRD Project on Rapid Problem Setup for Mesh-Based Simulation (Rapsodi)

Brown, D. L.; Henshaw, W.; Petersson, N. A.; Fast, P.; Chand, K.; Feb. 07, 2003; In English

Report No.(s): DE2003-15003249; UCRL-ID-151735; No Copyright; Avail: National Technical Information Service (NTIS)

Under LLNL Exploratory Research LDRD funding, the Rapsodi project developed rapid setup technology for computational physics and engineering problems that require computational representations of complex geometry. Many simulation projects at LLNL involve the solution of partial differential equations in complex 3-D geometries. A significant bottleneck in carrying out these simulations arises in converting some specification of a geometry, such as a computer-aided design (CAD) drawing to a computationally appropriate 3-D mesh that can be used for simulation and analysis. Even using state-of-the-art mesh generation software, this problem setup step typically has required weeks or months, which is often much longer than required to carry out the computational simulation itself. The Rapsodi project built computational tools and designed algorithms that help to significantly reduce this setup time to less than a day for many realistic problems. The project targeted rapid setup technology for computational physics and engineering problems that use mixed-element unstructured meshes, overset meshes or Cartesian-embedded boundary (EB) meshes to represent complex geometry. It also built tools that aid in constructing computational representations of geometry for problems that do not require a mesh. While completely automatic mesh generation is extremely difficult, the amount of manual labor required can be significantly reduced. By developing novel, automated, component-based mesh construction procedures and automated CAD geometry repair and cleanup tools, Rapsodi has significantly reduced the amount of hand crafting required to generate geometry and meshes for scientific simulation codes.

NTIS

Computerized Simulation; Grid Generation (Mathematics); Computational Geometry; Computer Aided Design

20030067156

LDRD Final Report. New Directions for Algebraic Multigrid: Solutions for Large Scale Multiphysics Problems

Henson, V. E.; Feb. 06, 2003; In English

Report No.(s): DE2003-15003247; UCRL-ID-151775; No Copyright; Avail: National Technical Information Service (NTIS)

The purpose of this research project was to investigate, design, and implement new algebraic multigrid (AMG) algorithms to enable the effective use of AMG in large-scale multiphysics simulation codes. These problems are extremely large; storage requirements and excessive run-time make direct solvers infeasible. The problems are highly ill-conditioned, so that existing iterative solvers either fail or converge very slowly. While existing AMG algorithms have been shown to be robust and stable for a large class of problems, there are certain problems of great interest to the Laboratory for which no effective algorithm existed prior to this research.

NTIS

Algorithms; Physics; Multigrid Methods

20030067366 National Inst. of Standards and Technology, Gaithersburg, MD

NIST HumanID Evaluation Framework

McCabe, R. M.; Jan. 31, 2003; 14 pp.; In English

Report No.(s): PB2003-105465; No Copyright; Avail: CASI; A03, Hardcopy

The NIST HumanID Evaluation Framework, or HEF, is an effort to design, implement, and deploy standards for the robust and complete documentation of the biometric system evaluation process. The HEF is an attempt to leverage contemporary technologies, specifically XML, for the formal description of such tests. The HEF was used to facilitate the administration of the 2002 Face Recognition Vendor Test, or FRVT 2002. Unlike FRVT 2000 or FERET 96, FRVT 2002 used both still and

video facial imagery, warranting the development of a more sophisticated and regular means of describing data presented to the participants.

NTIS

Imagery; Biometrics

20030067564 Tampere Univ. of Technology, Finland

Generating Proof-Specific Strategies for PVS

Pertti, Kellomaeki; Design and Application of Strategies/Tactics in Higher Order Logics; September 2003, pp. 91-102; In English; See also 20030067561

Contract(s)/Grant(s): AF-102536; No Copyright; Avail: CASI; [A03](#), Hardcopy

We describe how generated PVS proof strategies were used to partially automate invariant proofs of joint action specifications. A user writes specifications using the Disco specification language, and a compiler maps the specifications to PVS theories accompanied with custom strategies for verifying invariance theorems in the theories.

Author

Theorem Proving; Computer Programming

20030067565 Massachusetts Inst. of Tech., Cambridge, MA, USA

Developing Strategies for Specialized Theorem Proving about Untimed, Timed, and Hybrid I/O Automata

Mitra, Sayan; Archer, Myla; Design and Application of Strategies/Tactics in Higher Order Logics; September 2003, pp. 103-107; In English; See also 20030067561; No Copyright; Avail: CASI; [A01](#), Hardcopy

In this paper we discuss how we intend to develop a specialized theorem proving environment for the Hybrid I/O Automata (HIOA) framework [7] over the PVS [11] theorem prover, and some of the issues involved. In particular, we describe approaches to using PVS that allow and encourage the development of useful proof strategies, and note some desired PVS features that would further help us to do so for our HIOA environment.

Author

Theorem Proving; Automata Theory

20030067568 Ecole Normale Supérieure, Cachan, France

Coq Tacticals and PVS Strategies: A Small Step Semantics

Kirchner, Florent; Design and Application of Strategies/Tactics in Higher Order Logics; September 2003, pp. 69-83; In English; See also 20030067561

Contract(s)/Grant(s): NCC1-02043; No Copyright; Avail: CASI; [A03](#), Hardcopy

The need for a small step semantics and more generally for a thorough documentation and understanding of Coq's tacticals and PVS's strategies arise with their growing use and the progressive uncovering of their subtleties. The purpose of the following study is to provide a simple and clear formal framework to describe their detailed semantics, and highlight their differences and similarities.

Author

Semantics; Theorem Proving

20030067569 Reading Univ., UK

Rippling in PVS

Adams, A. A.; Dennis, L. A.; Design and Application of Strategies/Tactics in Higher Order Logics; September 2003, pp. 84-90; In English; See also 20030067561; No Copyright; Avail: CASI; [A02](#), Hardcopy

Rippling is a method of controlling rewriting of the terms in an induction step of an inductive proof, to ensure that a position is reached whereby the induction hypothesis can be applied. Rippling was developed primarily by the Mathematical Reasoning Group at the University of Edinburgh. The primary implementations are in the two proof planning systems Clam and XClam. An implementation is also available in HOL. In this paper we explain how we plan to implement rippling as a tactic for automatic generation of proofs requiring induction in PVS. Rippling has mostly been used as part of a larger project for developing high-level proof strategies, but has rarely been applied to 'real-world' examples. Once we have this implementation we intend to assess the utility of this as a tactic by running rippling on the large number of inductive proofs developed by Gottlieb as part of the PVS Real Analysis library [8]. By comparing the performance of the automation offered by rippling on these proofs with the original proof, which were proved by a combination of hand-generation of proofs

and by existing PVS strategies, we hope to assess the utility of rippling as a technique for real-world applications.

Author

Theorem Proving; Mathematical Logic

20030067663 Newcastle-upon-Tyne Univ., Newcastle

Anticipatory Adjointness of E-Science Computation on the Grid

Rossiter, B. N.; Heather, M. A.; Apr. 2003; 26 pp.

Report No.(s): PB2003-105163; CS-TR-771; Copyright; Avail: National Technical Information Service (NTIS)

Information systems are anticipatory systems providing knowledge of the real world. If e-science is to operate reactively across the Grid it needs to be integrable with other information systems and e-commerce. Theory suggests that four strong-anticipatory levels of computational types are sufficient to provide ultimate systemic closure with a single strong anticipation. Between the four levels are three layers of adjoint functors that relate each type-pair. A free functor allows selection of a target type at a lower level and its right adjoint determines the higher-level type. Because of the uniqueness a higher-level anticipates a lower level and a lower level a higher. Type anticipation can be provided by left (F) or right (G) adjoint functors. These however are weak anticipation. Strong anticipation needs both left and right adjoints at each level or by composition of adjoints for the system as a whole.

NTIS

Information Systems; Electronic Commerce

20030067667 Newcastle-upon-Tyne Univ., Newcastle

Structured Approach to Handling On-Line Interface Upgrades

Jones, C.; Romanovsky, A.; Welch, I.; Apr. 2003; 14 pp.; In English

Report No.(s): PB2003-105164; CS-TR-770; Copyright; Avail: National Technical Information Service (NTIS)

The integration of complex systems out of existing systems is an active area of research and development. There are many practical situations in which the interfaces of the component systems, for example belonging to separate organizations, are changed dynamically and without notification. In this paper the authors propose an approach to handling such upgrades in a structured and disciplined fashion. All interface changes are viewed as abnormal events and general fault tolerance mechanisms (exception handling, in particular) are applied to dealing with them. The paper outlines general ways of detecting such interface upgrades and recovering after them. An Internet Travel Agency is used as a case study.

NTIS

On-Line Systems; Internets

60

COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see *33 Electronics and Electrical Engineering*. For computer vision see *63 Cybernetics, Artificial Intelligence and Robotics*.

20030067265 Carnegie-Mellon Univ., Pittsburgh, PA

SEI Architecture Analysis Techniques and When to Use them

Barbacci, Mario R.; Oct. 2002; 34 pp.; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A413696; CMU/SEI-2002-TN-005; No Copyright; Avail: CASI; [A03](#), Hardcopy

The Software Engineering Institute (SEISM) has developed two methods for analyzing system and software architectures--the Quality Attribute Workshop (QAW) and the Architecture Tradeoff Analysis MethodSM (ATAMsM). These techniques, which are described in detail in various SEI technical reports and on the SEI Web site, can be used in combination to obtain early and continuous benefits. Designed to complement the ATAM, the QAW provides a method for analyzing a conceptual architecture or a system architecture against a number of critical quality attributes--such as availability, performance, security, interoperability, and modifiability--before the software architecture is fully developed. Once the software architecture is developed, the ATAM can be used to reveal how well the architecture satisfies particular quality attribute requirements and the risks, sensitivities, and tradeoffs involved in satisfying the requirements. The purpose of this technical note is to describe, using a hypothetical example, the alignment, combination, and uses of the two methods.

DTIC

Software Engineering; Tradeoffs; Architecture (Computers); Computer Programs

20030067269 Carnegie-Mellon Univ., Pittsburgh, PA

A Basis for an Assembly Processor for COTS-Based Systems (APCS)

Carney, David J.; Oberndorf, Patricia A.; Place, Patrick R. H.; May 2003; 46 pp.; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A413706; CMU/SEI-2003-TR-010; ESC*-TR-2003-010; No Copyright; Avail: CASI; [A03](#), Hardcopy

This paper describes a generic process framework for developing software systems based on commercial off-the-shelf (COTS) products. The framework is based on Barry Boehm's familiar spiral development process. However, it is primarily intended for projects that make significant use of commercial components and other preexisting software as elements of the system to be fielded. The aspects of the process that are most affected by this reliance on COTS components lie in the area of requirements, and the description of the process is most extensive in that area. The necessity of using system prototypes as the major vehicle for reducing risk is assumed, as are parallel and interleaved periods of gathering and refining knowledge about the system to be built. Each element of the process is first described and then depicted in several models, using Integrated Definition modeling technique (IDEFO). The paper describes how the interactions between the candidate COTS components, the stakeholders' implicit and explicit needs, and the context in which the system will operate all provide interacting constraints on both the process and the resulting system.

DTIC

Commercial Off-The-Shelf Products; Software Engineering; Computer Systems Programs; Prototypes

20030067272 Carnegie-Mellon Univ., Pittsburgh, PA

Deriving Architectural Tactics: A Step Toward Methodical Architectural Design

Bachmann, Felix; Bass, Len; Klein, Mark; Mar. 2003; 66 pp.; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A413701; CMU/SEI-2003-TR-004; No Copyright; Avail: CASI; [A04](#), Hardcopy

This is one of several reports that provide the current status on the work being done by the Software Engineering Institute (SEIsm) to understand the relationship between quality requirements and architectural design. The ultimate objective of this work is to provide analysis-based guidance to designers so that the quality attributes of generated designs are more predictable and better understood. Currently, four distinct problems must be solved to achieve that objective: (1) the precise specification of quality attribute requirements, (2) the enumeration of architectural decisions that can be used to achieve desired quality attribute requirements, (3) a means of coupling one quality attribute requirement to the relevant architectural decisions, and (4) a means of composing the relevant architectural decisions into a design. Embodying the solutions to these four problems into a design method that is sensitive to business priorities is an additional problem. This report deals with the third problem-coupling one quality attribute requirement to architectural decisions that achieve it. This report provides initial evidence that there is, in fact, a systematic relationship between general scenarios, concrete scenarios, architectural tactics, and design fragments. It examines, in detail, two concrete scenarios for performance and one for modifiability-and describes how to move from each scenario, through tactics, to design fragments that satisfy the scenario.

DTIC

Computer Aided Design; Computer Programming; Architecture (Computers)

20030067326 California Inst. of Tech., Pasadena, CA

Parallel Hardware Infrastructure for Research and Education in Computational Electromagnetics

Bruno, Oscar; May 2003; 2 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0240

Report No.(s): AD-A414215; AFRL-SR-AR-TR-03-0176; No Copyright; Avail: CASI; [A01](#), Hardcopy

For a period of approximately six months our research group (including postdocs and students involved in the computational electro-magnetics effort as well as the departmental system administrator) tin t with approximately three to four vendors per month, and had meetings to consider the various infrastructures offered. After this period a focus was developed on Intel Pentium IV Xeon based systems. Upon further consideration of the most competitive pricing quality of service and reliability the decision was reached to purchase the system front promicro systems, a vendor base based in the San Diego area. The system consists of 256 processors, arranged as a group of 128 dual Intel Pentium IV Xeon 1.7 GHz boxes, each one with 1 Gb of RAM. In addition the system has a 0.5 Tb Raid, an subsystem containing 16 boxes interconnected by an ultra-fast Myrubet interconnect, as well as Gb Ethernet in another 16 box subsystem. The system was housed in a room fully-refurbished for this purposes, with support (\$80k) provided in its entirety by the Caltech provost office. In addition, the Caltech provosts

office provided matching funds for the computer purchase in the amount of \$120k.

DTIC

Computational Electromagnetics; Education; Research And Development; Parallel Processing (Computers)

20030067379 NASA Ames Research Center, Moffett Field, CA, USA

Compressing Aviation Data in XML Format

Patel, Hemil; Lau, Derek; Kulkarni, Deepak; [2003]; 10 pp.; In English; World Aviation Congress, 8 Sep. 2003, Palais Congress, Montreal, Canada; Copyright; Avail: CASI; [A02](#), Hardcopy

Design, operations and maintenance activities in aviation involve analysis of variety of aviation data. This data is typically in disparate formats making it difficult to use with different software packages. Use of a self-describing and extensible standard called XML provides a solution to this interoperability problem. XML provides a standardized language for describing the contents of an information stream, performing the same kind of definitional role for Web content as a database schema performs for relational databases. XML data can be easily customized for display using Extensible Style Sheets (XSL). While self-describing nature of XML makes it easy to reuse, it also increases the size of data significantly. Therefore, transferring a dataset in XML form can decrease throughput and increase data transfer time significantly. It also increases storage requirements significantly. A natural solution to the problem is to compress the data using suitable algorithm and transfer it in the compressed form. We found that XML-specific compressors such as Xmill and XMLPPM generally outperform traditional compressors. However, optimal use of Xmill requires discovery of optimal options to use while running Xmill. This, in turn, depends on the nature of data used. Manual discovery of optimal setting can require an engineer to experiment for weeks. We have devised an XML compression advisory tool that can analyze sample data files and recommend what compression tool would work the best for this data and what are the optimal settings to be used with a XML compression tool.

Author

Civil Aviation; Document Markup Languages; Format; Data Processing; Operating Systems (Computers); Data Compression

20030067426 Michigan Univ., Ann Arbor, MI

Block-Based Multi-Period Refresh for Energy Efficient Dynamic Memory

Kim, Joohee; Papaefthymiou, Marios C.; Apr. 2, 2002; 7 pp.; In English

Contract(s)/Grant(s): DAAD19-99-1-0304

Report No.(s): AD-A414244; ARO-39863.15-EL; No Copyright; Avail: CASI; [A02](#), Hardcopy

DRAMs are widely used in portable applications due to their high storage density. In standby mode their main source of power dissipation is the refresh operation that periodically restores leaking charge in each cell to its correct level. Conventional DRAMs use a single refresh period determined by the cell with the largest leakage. This approach is simple but dissipative, because it forces unnecessary refreshes for the majority of the cells with small leakage. In this paper we investigate a novel scheme that relies on multiple refresh periods and small refresh blocks to reduce DRAM dissipation by decreasing the number of cells refreshed too often. Long periods are used to accommodate cells with small leakage. In contrast to conventional row-based refresh, small refresh blocks are used to increase worst case data retention times. Retention times are further extended by adding a swap cell to each refresh block. We give a novel polynomial-time algorithm for computing an optimal set of refresh periods for block-based multiperiod refresh. Specifically, given an integer K and a distribution of data retention times, in $O(KN^2)$ steps our algorithm computes K refresh periods that minimize DRAM dissipation, where N is the number of refresh blocks in the memory. We describe and evaluate a possible implementation of our refresh scheme. In simulations with a 16Mb DRAM, block-based multi-rate refresh reduces standby dissipation by a multiplicative factor of 4 with area overhead below 6%.

DTIC

Random Access Memory; Architecture (Computers)

61

COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20030066265 Maryland Univ., College Park, MD

Handling Contradictory Data with Metareasoning

Perlis, Donald; Anderson, Michael; Nov. 30, 2002; 9 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0068

Report No.(s): AD-A414208; AFRL-SR-AR-TR-03-0173; No Copyright; Avail: CASI; [A02](#), Hardcopy

Our work has involved extending the meta-reasoning capabilities of the Active Logic inference engine (ALMA) to be able to represent a variety of types of contradiction and positive and negative introspection. This involved both theoretical and implementation effort. In particular, we developed techniques for representing, recognizing, and repairing mistakes that arise in the form of contradictions in the evolving belief set of an agent. This had two aspects: general (commonsense) reasoning, and reasoning attendant to natural-language dialogue. This work led to a number of other publications (see below), including a PhD dissertation completed in 2001.

DTIC

Machine Learning; Inference; Data Processing; Logic Programming

20030066266 Maryland Univ., College Park, MD

Metareasoning for More Effective Human-Computer Dialogue

Perlis, Don; Anderson, Mike; Dec. 31, 2002; 8 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0336

Report No.(s): AD-A414209; AFRL-SR-AR-TR-03-0175; No Copyright; Avail: CASI; [A02](#), Hardcopy

The research project explores specific meta-dialogue behaviors in terms of both how a system could be made to perform them, and to what extent they can increase overall system performance. We focus on two types of meta-dialogue capabilities: ability to detect and recover from anomalous dialogue patterns in simple exchanges, and on-line extensions or changes to working vocabulary. Our main method involves detailed representation of the dialogue context, separating domain, language, and dialogue specific aspects, and significant amounts of meta-reasoning about the system's processing of these representations. An existing logical inference system, ALMA/CARNE, developed as part of a pilot study, is being used in an implementation phase of this work. We are also engaged in a study of existing dialogue corpora to investigate the range and frequency of meta-dialogue expressions in different task domains.

DTIC

Human-Computer Interface; Machine Learning; Computer Systems Programs; Data Processing

20030066340 Range Commanders Council, White Sands Missile Range, NM, USA

Asynchronous ASCII Composite Count Data Format

Jul. 2002; 14 pp.; In English

Report No.(s): AD-A412904; IRIG-STANDARD-216-02; No Copyright; Avail: CASI; [A03](#), Hardcopy

This standard describes an American Standard Code for Information Interchange (ASCII) count data format used to transfer count data (See appendix A) over conventional asynchronous telecommunications circuits. This standard provides formats for count data information suitable for commercial-off-the-shelf (COTS) message display units (MDUs).

DTIC

Telecommunication; Hybrid Circuits

20030066439 NASA Ames Research Center, Moffett Field, CA, USA

Facilitating the Portability of User Applications in Grid Environments

Kolano, Paul Z.; June 13, 2003; 6 pp.; In English; 4th IFIP Conference on Distributed Application and Interdependable Systems, 19-21 Nov. 2003, Paris, France

Contract(s)/Grant(s): DTTS59-99-0-00437; NASA Order A-61812-D; No Copyright; Avail: CASI; [A02](#), Hardcopy

Grid computing promises the ability to connect geographically and organizationally distributed resources to increase effective computational power, resource utilization, and resource accessibility. For grid computing to be successful, however, users must be able to easily execute the same application on different resources. Different resources, however, may be administered by different organizations with different software installed, different file system structures, and different default environment settings. Even within the same organization, the set of software installed on a given resource is in constant flux with additions, upgrades, and removals. Users cannot be expected to understand all of the idiosyncrasies of each resource they may wish to execute jobs on, thus must be provided with automated assistance. This paper describes a new OGSi-compliant grid service (the Portability Manager) that has been implemented as part of NASA's Information Power Grid (IPG) project to automatically establish the execution environment for user applications.

Author

Computational Grids; Applications Programs (Computers); Computer Programming; Elastic Properties

20030066959 Carnegie-Mellon Univ., Pittsburgh, PA

Architecture Reconstruction Case Study

O'Brien, Liam; Stoermer, Christoph; Apr. 2003; 26 pp.; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A413856; CMU/SEI-2003-TN-008; No Copyright; Avail: CASI; [A03](#), Hardcopy

This report outlines an architecture reconstruction carried out at the Software Engineering Institute (SEISM) on a software system called VANISH that was developed for prototyping visualizations. The goals of the reconstruction were to understand the existing VANISH system and to use a new architecture reconstruction tool called ARMIN, for the reconstruction while ensuring that ARMIN has at least the same capabilities as the Dali Architecture Reconstruction Workbench. During the reconstruction several architectural views were generated through abstraction of low-level information extracted from the system. These views show the components of the system and the interfaces among them. The ARMIN tool provides the ability to visualize navigate, and manipulate the set of views generated, and yields results technically compatible with the Dali Workbench but with improved presentation and layout

DTIC

Software Engineering; Architecture (Computers)

20030067220 Carnegie-Mellon Univ., Pittsburgh, PA

PECT Infrastructure: A Rough Sketch

Hissam, Scott; Ivers, James; Dec. 2002; 42 pp.; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A413548; CMU/SEI-2002-TN-033; No Copyright; Avail: CASI; [A03](#), Hardcopy

A prediction/enabled component technology (PECT) is an approach to achieving predictable assembly from certifiable components. A PECT consists of a component technology that has been extended with one or more reasoning frameworks that are used to predict how assemblies of components will behave. Developing and using a PECT involves a number of different activities, many of which are practical only when supported by automation. This paper investigates the nature of PECT infrastructures, summarizes the activities that a PECT infrastructure should support, and proposes a design for the tools that make up a PECT infrastructure. This paper also considers the reusability of such an infrastructure by evaluating the impact that three possible changes to a PECT have on its infrastructure.

DTIC

Prediction Analysis Techniques; Component Reliability

20030067236 Jackson (Henry M.) Foundation, Rockville, MD, USA

Development of Internet-Accessible Prediction Models for Prostate Cancer Diagnosis, Treatment, and Follow-Up

Sun, Leon; Moul, Judd W.; Wu, Hongyu; Bensouda, Fatiha; Wu, Holly; Jan. 2003; 123 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0066

Report No.(s): AD-A413542; No Copyright; Avail: CASI; [A06](#), Hardcopy

The objective of the development of Internet-accessible prediction models is to enhance the diagnosis accuracy, treatment efficacy and prognosis for patients with carcinoma of prostate cancer (Cap). An Oracle database was created, and Internet-accessible data collection applications were developed. Program packages for daily data retrieval, standardization, and reorganization were built. The roles of variables (race/ethnicity, diagnostic age, labs - and treatment types) on the outcome of CaP patients were analyzed. The results show that CaP patients who chose watchful waiting tend to be older with lower serum PSA and lower Gleason score. The age at diagnosis, diagnostic PSA and clinical T-stage are the most significant predictors of secondary treatment in watchful waiting (submitted to J Urol). Pre-treatment testosterone level is a predictor of PSA recurrence (accepted for publication in J Urol). Post-treatment PSA doubling time less than 3 months is a surrogate for prostate cancer specific mortality following surgery or radiation therapy (submitted to J Urol). Biostatistical models with variables of race, pre-treatment PSA, clinical stage, pathological stage and Gleason sum for predicting PSA recurrence before and after radical prostatectomy were implemented on CPDR webpage (www.cpdr.org). Further data analysis and the development of the prediction models are in progress.

DTIC

Cancer; Prostate Gland; Data Acquisition

20030067241 University of Southern California, Marina del Rey, CA

Agents for Plan Monitoring and Repair

Knoblock, Craig A.; Lerman, Kristina; Minton, Steve; Muslea, Ion; Apr. 2003; 150 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-98-2-0109; Proj-AGEN

Report No.(s): AD-A413560; AFRL-IF-RS-TR-2003-84; No Copyright; Avail: CASI; [A07](#), Hardcopy

A key aspect to the successful planning and execution of tasks in an agent-enabled organization is the timely access to up-to-date information. Agents making decisions on behalf of human users need to access and verify information from multiple heterogeneous information sources, such as internal organizational databases (personal schedules, staff lists), real-time sensors (traffic and weather updates), as well as many types of public information (airline schedules, restaurant listings, etc). To address the problems of accessing and verifying information from heterogeneous sources, we developed a set of techniques for learning to recognize the content of the required information. The capability makes it possible to automatically access and maintain wrappers to extract data from online sources. It also provides semantic interoperability among software agents: to verify information from other agents, identify semantic mismatches in data, as well as automatically determine the type of information being communicated by an agent.

DTIC

Information Retrieval; Information Systems; Interoperability

20030067243 Carnegie-Mellon Univ., Pittsburgh, PA

Volume III: A Technology for Predictable Assembly from Certifiable Components

Wallnau, Kurt C.; Apr. 2003; 98 pp.; In English

Report No.(s): AD-A413574; CMU/SEI-2003-TR-009-VOL-3; ESC-TR-2003-009-VOL-3; No Copyright; Avail: CASI; [A05](#), Hardcopy

This report is the final volume in a three-volume series on component-based software engineering. Volumes I and II identified market conditions and technical concepts of component-based software technology respectively. Volume III (this report) focuses on how component technology can be extended to achieve predictable assembly from certifiable components (PACC). An assembly of software components is predictable if its runtime behavior can be predicted from the properties of its components and their patterns of interactions. A component is certifiable if its (predictive) properties can be objectively measured or otherwise verified by independent third parties. This report identifies the key technical concepts of PACC with an emphasis on the theory of prediction-enabled component technology (PECT).

DTIC

Computer Programs; Predictions

20030067295 Naval Postgraduate School, Monterey, CA

Inertial Motion Tracking Technology for Inserting Humans into a Networked Synthetic Environment

Zyda, Michael J.; Yun, Xiaoping; Bachmann, Eric; McGhee, Robert B.; Apr. 2002; 6 pp.; In English

Report No.(s): AD-A414542; ARO-37660.1-MA; No Copyright; Avail: CASI; [A02](#), Hardcopy

A novel hybrid inertial and magnetic human body motion tracking system was developed for inserting humans into virtual environments. The system is composed of two main components: in-house designed MARG sensors and a complementary data processing filter. Each MARG sensor is a nine-axis sensor consisting of a three-axis magnetometer a three-axis angular rate sensor: and a three-axis accelerometer and offers one-degree accuracy which is sufficient for human body motion tracking. The complementary filter is based on quaternions avoiding orientation singularities associated with Euler angles, and significantly reducing the computational requirements by not using any trigonometric functions. The filter is designed to take advantage of complementary information provided by high frequency angular rate data and low frequency magnetometer and accelerometer data. A tracking system with three MARG sensors was prototyped and demonstrated. Testing results indicated that the system offers superior performance compared with commercially available products. A patent on the MARG tracking system was filed in October 2001.

DTIC

Computerized Simulation; Virtual Reality; Distributed Interactive Simulation

20030067325 Wisconsin Univ., Madison, WI

Data Mining via Generalized Support Vector Machines

Mangasarian, Olvi L.; Jan. 21, 2003; 13 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0085

Report No.(s): AD-A414231; AFRL-SR-AR-TR-03-0174; No Copyright; Avail: CASI; [A03](#), Hardcopy

Generalized Support Vector Machines were used to extract valuable information from datasets and construct fast classification algorithms for massive data. The influence of chemotherapy was investigated on breast cancer patients by obtaining well separated Kaplan-Meier survival curves for three classes of patients. A novel approach was proposed for using a minimal number of data points in order to generate an accurate classifier. Substantial progress was also made towards achieving new results in the field of data mining by using the extremely versatile and highly effective approach of support vector machines. In particular, minimal kernel classifiers were constructed that use minimal subset of the data. A new type of classifier, the proximal classifier, was proposed and implemented which is basically an order of magnitude faster than conventional classifiers. The effect of chemotherapy on breast cancer patients was more accurately assessed. An incremental classification algorithm was proposed, implemented and was capable of classifying a billion points in less than three hours on a 400Mhz machine. New techniques for incorporating prior expert knowledge such as medical doctors experience into classifiers were devised and computationally implemented. Very fast Newton methods were proposed and successfully tried for extremely large classification problems and linear programming problems.

DTIC

Data Mining; Linear Programming; Applications Programs (Computers); Medical Science

20030067335 Army Research Lab., Aberdeen Proving Ground, MD

CYCLOPS, A Breakthrough Code to Predict Solid-Propellant Burning Rates

Miller, Martin S.; Anderson, William R.; Feb. 2003; 68 pp.; In English

Report No.(s): AD-A414455; ARL-TR-2910; No Copyright; Avail: CASI; [A04](#), Hardcopy

Theoretical capability to predict the burning rate of real propellants from their ingredients would be an invaluable aid to formulating new propellants. Despite progress over the last decade on a very few simple ingredients, such as cyclotrimethylenetrinitramine (RDX), and a few simple binary mixtures, no general capability of this sort exists today. This shortcoming is not due to insufficient computational resources, but to a lack of understanding of fundamental combustion mechanisms in the condensed phase and surface(gas interlace for typical propellant ingredients and their mixtures. This difficult problem is likely to remain intractable for some time to come. In this report, we demonstrate that our previously published semi-empirical formalism for single ingredients can be success fully extended to treat multi-ingredient propellants. In particular, for purposes of this report, we confine ourselves to nitrate-ester propellants, using M10, M2, M9, and JA2 as examples. However, the method should also be applicable to other classes of homogeneous propellants and even composite propellants where mixing of ingredients in a surface melt layer or sufficiently small particle sizes remove the multi-dimensional character. The method treats the gas-phase processes on the level of elementary reaction and multicomponent transport. A semi-empirical pyrolysis law coupled with informed estimates of the decomposition products of the condensed phase enables us to finesse the absence of knowledge of the detailed processes occurring in the condensed phase and at the burning surface. Results of a computer code, CYCLOPS, based on this approach, show that both the burning rate and flame structure are well predicted for a series of four U. S. Army gun propellants.

DTIC

Numerical Analysis; Computer Programs; Burning Rate; Gun Propellants; Solid Propellants; Composite Propellants

20030067367 Carnegie-Mellon Univ., Pittsburgh, PA, USA

Effective Team Support: From Modeling to Software Agents

Remington, Roger W., Technical Monitor; John, Bonnie; Sycara, Katia; [2003]; 10 pp.; In English

Contract(s)/Grant(s): NAG2-1472; No Copyright; Avail: CASI; [A02](#), Hardcopy

The purpose of this research contract was to perform multidisciplinary research between CMU psychologists, computer scientists and engineers and NASA researchers to design a next generation collaborative system to support a team of human experts and intelligent agents. To achieve robust performance enhancement of such a system, we had proposed to perform task and cognitive modeling to thoroughly understand the impact technology makes on the organization and on key individual personnel. Guided by cognitively-inspired requirements, we would then develop software agents that support the human team in decision making, information filtering, information distribution and integration to enhance team situational awareness. During the period covered by this final report, we made substantial progress in modeling infrastructure and task infrastructure. Work is continuing under a different contract to complete empirical data collection, cognitive modeling, and the building of software agents to support the teams task.

Author

Data Acquisition; Human Behavior; Computerized Simulation

20030067376 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA

What Went Wrong: Explaining Counterexamples

Groce, Alex; Visser, Willem; November 2002; 17 pp.; In English

Contract(s)/Grant(s): NCC2-1006

Report No.(s): RIACS-TR-02.08; Copyright; Avail: CASI; [A03](#), Hardcopy

Model checking, initially successful in the field of hardware design, has recently been applied to software. One of the chief advantages of model checking is the production of counterexamples demonstrating that a system does not satisfy a specification. However, it may require a great deal of human effort to extract the essence of an error from even a detailed source-level trace of a failing run. We use an automated method for finding multiple versions of an error (and similar executions that do not produce an error), and analyze these executions to produce a more succinct description of the key elements of the error. The description produced includes identification of portions of the source code crucial to distinguishing failing and succeeding runs, differences in invariants between failing and non-failing runs, and information on the necessary changes in scheduling and environmental actions needed to cause successful runs to fail. In addition, this analysis allows a classification of errors by features such as whether they are purely concurrent (i.e. can be induced by changing only thread scheduling).

Author

Algorithms; Computer Systems Programs; Computer Programming; Design Analysis; System Failures

20030067383 Pennsylvania Univ., Philadelphia, PA

Engineering Robust Distributed Database Software

Tannen, Val; Buneman, Peter; Davidson, Susan; May 31, 2001; 13 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0331

Report No.(s): AD-A414373; ARO-38743.1-CI; No Copyright; Avail: CASI; [A03](#), Hardcopy

The research has focused on a technology for mobile information management. Underlying this technology is a mathematical foundation enabling the use of formal methods in developing and reasoning about the construction of mobile information management components and their use in database integration and transformation. The salient features of our approach are: use of unmaterialized views; dynamic integration of data consumers and data sources, using mobile query processes; data interface specifications, based on XML schemas; specifications for transformations, based on XML query languages; the development of formal methods, focusing on query and constraint reformulation.

DTIC

Information Retrieval; Computer Programming; Information Management; Computer Programs

20030067384 Sandia National Labs., Albuquerque, NM

Design of Largest Shaped Charge: Generation of Very Large Diameter, Deep Holes in Rock and Concrete Structures

Vigil, Manuel G.; Apr. 2003; 120 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DE-AC04-94AL85000

Report No.(s): AD-A414599; SAND2003-1160; No Copyright; Avail: CASI; [A06](#), Hardcopy

This report documents the design at Sandia National Laboratories (SNL) of the largest known conical shaped charge (CSC). This CSC was designed specifically to generate a very large hole diameter and a substantial jet penetration depth in hard rock and concrete structures as part of the Cruise Missile Program. The charge will fit in the existing volume between the missile body and the PEN-X penetrator weapon that it carries. The CSC jet produces a hole in a hard rock or concrete target with a hole profile such that the penetrator precursor deceleration loads are reduced sufficiently to allow the weapon components to function successfully at maximum penetration depth. Additionally, the precursor hole will allow substantially deeper penetration into the target to obtain good coupling at the rock or concrete interface, thus allowing the maximum shock or stress wave transmission into the target when the weapon is detonated. A parametric study was conducted using the Shaped Charge Analysis Program (SCAP) code to design this 28 inch outside diameter by 28.5 inch long CSC. The total charge weight was about 900 pounds. The total weight of Octol explosive was about 600 pounds.

DTIC

Shaped Charges; Conical Bodies; Explosives

20030067416 Defence Science and Technology Organisation, Salisbury, Australia

An Automated Method of Facilitating Analysis of Voice Communications

Clark, Philip G.; Dickinson, Rowland E.; Nov. 2002; 21 pp.; In English

Report No.(s): AD-A414414; DSTO-TN-0447; DODA-AR-012-410; X5-X5; No Copyright; Avail: CASI; [A03](#), Hardcopy

DSTO has historically gathered voice communications data for analysis. Preparing this data for analysis is very time intensive and in many cases cannot be undertaken due to resource constraints. This paper describes a simple computer tool to automatically log and compress live communications activity or previously tape recorded analogue information. The tool presents this information in a form ready for immediate computer based analysis.

DTIC

Computer Techniques; Information Analysis; Voice Communication

20030067464 Maryland Univ., College Park, MD

Optimizing Heavily Loaded Agents

Subrahmanian, V. S.; Jun. 10, 2003; 6 pp.; In English

Contract(s)/Grant(s): DAAD19-00-1-0484

Report No.(s): AD-A414341; ARO-41418.1-CI; No Copyright; Avail: CASI; [A02](#), Hardcopy

We develop algorithms to help scale software agents built on top of heterogeneous, legacy codebases. The algorithms apply to large data sets, to large volumes of workloads on agents, as well as algorithms for computationally intensive functions.

DTIC

Software Engineering; Algorithms; Heterogeneity

20030067467 Duke Univ., Durham, NC

Software Development for Electromagnetic Sensing of Surface and Subsurface Targets: Simulation and Signal Processing

Carin, Lawrence; May 20, 2003; 3 pp.; In English

Contract(s)/Grant(s): DAAD19-00-1-0175

Report No.(s): AD-A414352; ARO-41373.1-EL; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report summarizes research progress on the Duke University program to develop parallel (scalable) multi-level fast multi pole algorithm (MLFMA) software for the modeling of electromagnetic scattering from general surface and subsurface targets.

DTIC

Computer Programming; Electromechanical Devices; Detection; Target Recognition

20030067476 Army Engineer Research and Development Center, USA

Army Training and Testing Area Carrying Capacity (ATTACC) LS Factor Calculator User Manual, Version 1.0

Anderson, Alan B.; Mitasova, Helene; Hohmann, Matt; Warren, Steve; Aug. 2002; 42 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-SERDP

Report No.(s): AD-A414292; ERDC/CERL-SR-02-7; No Copyright; Avail: CASI; [A03](#), Hardcopy

Army Training and Testing Area Carrying Capacity (ATTACC) is the standard Integrated Training Area Management (ITAM) methodology for estimating training land carrying capacity by relating training load land condition and land maintenance practices. Various decision support tools have been developed to simplify and automate the ATTACC methodology. These decision support tools include the Workplan Analysis Module (WAM) ATTACC Integration Module (AIM) ATTACC functions of the Range Facility Management Support System (RFMSS) and Land Condition Module (LCM). The Land Condition Model (LCM) is an ArcView GIS-based software application that estimates changes in land condition associated with mission activity. LCM automates the ATTACC methodology for generating land condition curves. To implement the LCM an LS factor data layer is required that adequately represents complex landscapes typically found on military installation. The ATTACC LS Factor Calculator automates the development of LCM-required LS Factor data. The ATTACC LS Factor Calculator is an ArcView extension.

DTIC

User Manuals (Computer Programs); Armed Forces (United States); Software Engineering; Land Management; Education

20030067561 NASA Langley Research Center, Hampton, VA, USA

Design and Application of Strategies/Tactics in Higher Order Logics

Archer, Myla, Editor; diVito, Ben, Editor; Munoz, Cesar, Editor; September 2003; 116 pp.; In English; STRATA 2003: First International Workshop on Design and Application of Strategies/Tactics in Higher Order Logics, 8 Sep. 2003, Rome, Italy; See also 20030067562 - 20030067569

Contract(s)/Grant(s): WU 23-704-03-50

Report No.(s): NASA/CP-2003-212448; NAS 1.55:212448; L-18328; No Copyright; Avail: CASI; [A06](#), Hardcopy

This Proceedings includes both a paper from the implementors of PVS providing guidance for PVS strategy writers and a tutorial on PVS strategy writing distilled from the experience of three PVS users who have written extensive sets of PVS user strategies. Following these are three full papers from the higher-order logic theorem proving community that discuss PVS strategies to enhance arithmetic and other interactive reasoning in PVS; implementing first-order tactics in higher-order provers; and a proposed technique for specifying small step semantics that can be used in multiple higher order logic theorem provers, with illustrations from both Coq and PVS. The Proceedings concludes with three position papers for a panel session that discuss three settings in which development of PVS strategies is worth while.

Author

Theorem Proving; Semantics; Tactics

20030067562 SRI International Corp., Menlo Park, CA, USA

Writing PVS Proof Strategies

Owre, Sam; Shankar, Natarajan; Design and Application of Strategies/Tactics in Higher Order Logics; September 2003, pp. 1-15; In English; See also 20030067561; No Copyright; Avail: CASI; [A03](#), Hardcopy

PVS (Prototype Verification System) is a comprehensive framework for writing formal logical specifications and constructing proofs. An interactive proof checker is a key component of PVS. The capabilities of this proof checker can be extended by defining proof strategies that are similar to LCF-style tactics. Commonly used proof strategies include those for discharging typechecking proof obligations, simplification and rewriting using decision procedures, and various forms of induction. We describe the basic building blocks of PVS proof strategies and provide a pragmatic guide for writing sophisticated strategies.

Author

Theorem Proving; Computer Programming

20030067563 NASA Langley Research Center, Hampton, VA, USA

Developing User Strategies in PVS: A Tutorial

Archer, Myla; diVito, Ben; Munoz, Cesar; Design and Application of Strategies/Tactics in Higher Order Logics; September 2003, pp. 16-42; In English; See also 20030067561; No Copyright; Avail: CASI; [A03](#), Hardcopy

This tutorial provides an overview of the PVS strategy language, and explains how to define new PVS strategies and load them into PVS, and how to create a strategy package. It then discusses several useful techniques that can be used in developing user strategies, and provides examples that illustrate many of these techniques.

Author

Theorem Proving; Automation

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COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

20030066914 RAND Corp., Santa Monica, CA

Issue Paper: Research Topics for Informing Broadband Internet Policy

Balkovich, Edward; Baer, Walter S.; Vollaard, Ben; Jan. 2003; 6 pp.; In English

Report No.(s): AD-A413871; No Copyright; Avail: CASI; [A02](#), Hardcopy

This issue paper presents a set of candidate broadband research topics prepared by the RAND science and Technology Policy Institute (S&TPI) to assist the President's Council of Advisors on science and Technology (PCAST) Panel on 21st Century Infrastructure. The PCAST Panel is examining broadband Internet infrastructure with the goal of developing policy advice on speeding broadband deployment by addressing demand-related issues. As part of this process, OSTP staff has

requested that S&TPI develop and briefly describe examples of research whose results would inform broadband Internet policy choices. They exemplify research that might best be done at a national level, independent of particular stakeholders in the policy debate. They are representative of projects that could be undertaken by creating and privately funding an independent, nonprofit organization focusing on broadband research.

DTIC

Broadband; Internets; Policies

20030066955

Multi-Dimensional Security Management and Enforcement System (MSMES)

Condell, Matthew; Lynn, Charles; Colvin, Alex; Waltzman, David; Apr. 2003; 70 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-00-C-0062; DARPA ORDER J525

Report No.(s): AD-A413816; AFRL-IF-RS-TR-2003-71; No Copyright; Avail: CASI; [A04](#), Hardcopy

Multi-dimensional Security Management and Enforcement (MSME). The project is a 27-month effort to develop a system that will allow coalition partners to determine if their existing security policies can support the communication requirements of the coalition before the communications are required by focusing on policy abstraction, policy exchange, policy resolution, and policy monitoring. This report includes MSME accomplishments, results, lessons learned, and documented output.

DTIC

Warning Systems; Management Systems

20030066986 Carnegie-Mellon Univ., Pittsburgh, PA

Handbook for Computer Security Incident Response Teams (CSIRTs)

West-Brown, Molra J.; Stikvoort, Don; Kossakowski, Klaus-Peter; Killcrece, Georgia; Ruefle, Robin; Apr. 2003; 221 pp.; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A413778; CMU/SEI-2003-HB-002; No Copyright; Avail: CASI; [A10](#), Hardcopy

This document provides guidance on forming and operating a computer security incident response team (CSIRT). In particular, it helps an organization to define and document the nature and scope of a computer security incident handling service, which is the core service of a CSIRT. The document explains the functions that make up the service; how those functions interrelate; and the tools, procedures, and roles necessary to implement the service. This document also describes how CSIRTs interact with other organizations and how to handle sensitive information. In addition, operational and technical issues are covered, such as equipment, security, and staffing considerations. This document is intended to provide a valuable resource to both newly forming teams and existing teams whose services, policies, and procedures are not clearly defined or documented. The primary audience for this document is managers who are responsible for the creation or operation of a CSIRT or an incident handling service. It can also be used as a reference for all CSIRT staff, higher level managers, and others who interact with a CSIRT.

DTIC

Data Processing; Handbooks; Computer Information Security; Electronics

20030067226 Louisiana State Univ., Baton Rouge, LA

Dynamic Protocols for Reliable Query Reporting in Sensor Networks: Analytical Framework and Protocols

Kannan, Rajgopal; Sitharama Iyengar, S.; Sarangi, Sudipta; Apr. 2003; 26 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-01-1-0551; Proj-M280

Report No.(s): AD-A413545; AFRL-IF-RS-TR-2003-73; No Copyright; Avail: CASI; [A03](#), Hardcopy

An analytical model was formulated for reliably routing queries in sensor networks constrained to operate with unattended sensors possessing limited energy for communication under the possibility of sensor failure due to malfunction or enemy attack. By modeling the sensors as intelligent, game theory was used to define optimally reliable yet energy-constrained communication paths from the individual sensors point of view. Determining the optimal routing path was shown to be computationally intensive. Bounds on link costs and sensor failure probabilities under which the optimal routing path becomes congruent to practical routing paths such as the most reliable or maximally energy efficient path, were derived. The proposed game-theoretic model sets the stage for deriving practical distributed query routing algorithms that are reliable and energy-efficient from a sensor-centric point of view.

DTIC

Networks; Mathematical Models; Protocol (Computers)

20030067271 Michigan Univ., Ann Arbor, MI

Stochastic Control of Ad Hoc Communication Networks

Stark, Wayne E.; Wasserman, Kimberly; Oct. 31, 2002; 3 pp.; In English

Contract(s)/Grant(s): DAAD19-99-1-0148

Report No.(s): AD-A413776; No Copyright; Avail: CASI; [A01](#), Hardcopy

The proposed research had two main purposes. The first was to develop simple, adaptive, and distributed energy control (transmission power and transmission rate control) algorithms that (i) control the topology of wireless ad hoc communication networks, subject to traffic with diverse bandwidth and end-to-end quality of service requirements, in a spectrally and energy efficient manner; (ii) control multiple access interference and adapt to time-varying propagation losses; and (iii) combine with transmission scheduling, media access control, and multi-hop routing. The second is to design simple, efficient, and robust mechanisms to improve the performance of Transmission Control Protocol (TCP) in mixed wired/wireless communication and ad-hoc networks. The basic approach is to study how the soon-to-be-standardized Selective Acknowledgement feature of TCP, together with knowledge of the statistical behavior of wireless links, can be used to decouple the error recovery and flow control functions of TCP by distinguishing between congestion and non-congestion related packet loss.

DTIC

Access Control; Adaptive Control; Communication Networks; Protocol (Computers); Stochastic Processes

20030067382 Army War Coll., Carlisle Barracks, PA

Information Operations - Demands of Increased Cooperation Within the Cabinet and Between the State and the Private Sector

Hellquist, Ingvar; Apr. 7, 2003; 29 pp.; In English

Report No.(s): AD-A414596; No Copyright; Avail: CASI; [A03](#), Hardcopy

This paper presents a comparison of Swedish and U. S. perspectives on actions to reduce vulnerabilities in critical infrastructure when that infrastructure is attacked via Information Operations. It compares the U.S. and the Swedish definitions of Information Operations and offers an example of how Information Operations can be implemented. The paper stresses the need for increased cooperation among governments and increased awareness of a government's needs within the economic environment. With technological advancements occurring mostly in the private sector, no single actor is the owner of a critical information system. Yet information technology and globalization lead to the international arena and demand international cooperation. This paper suggests ways in which different actors (e.g., the Government, information system producers, suppliers of data and telecommunications equipment, financial institutions, insurance companies) can attain cooperation throughout a nation's critical systems. An area of special interest, because of their authority and collaboration in an asymmetric environment, is the role of police and military in protective Information Operations. The paper looks at the issues of global security, technological development, and economics as they affect Information Operations. The author stresses the need for developed forms of public-private cooperation and describes a way to organize traditional domestic responsibilities to keep pace with emerging information technology-related threats. The author also recommends new ways of handling crises and conflicts and enforcing sanctions in the international arena. Recommendations are provided for cross-sector security cooperation within the cabinet and between the State and private sector. (20 refs.)

DTIC

Data Processing Equipment; Military Operations; Telecommunication

20030067497 Defence Science and Technology Organisation, Salisbury, Australia

IP Convergence in Global Telecommunications - Mobility in IP Networks

Jayasinghe, Sana; Feb. 2003; 30 pp.; In English

Report No.(s): AD-A414429; DSTO-TR-1393; DODA-AR-012-593; X5-X5; No Copyright; Avail: CASI; [A03](#), Hardcopy

The paper describes the main techniques for providing mobility in an IP network. Towards this end the Mobile IP protocol is described in both its guises, namely MIPv4 and MIPv6. Fast mobility is addressed in the next section, and Cellular IP is chosen as the representative protocol. Then, the methods of providing mobility by using a cellular network is presented, and the paper concludes with the description of some common wireless standards.

DTIC

Protocol (Computers); Telecommunication; Internets; Computer Networks

20030067574 NASA Ames Research Center, Moffett Field, CA, USA, NASA Langley Research Center, Hampton, VA, USA

Enhanced Product Generation at NASA Data Centers Through Grid Technology

Barkstrom, Bruce R.; Hinke, Thomas H.; Gavali, Shradha; Seufzer, William J.; May 16, 2003; 10 pp.; In English; Workshop

on Grid Applications and Programming Tools at Global Grid Forum 8, 25 Jun. 2003, Seattle, WA, USA; Copyright; Avail: CASI; [A02](#), Hardcopy

This paper describes how grid technology can support the ability of NASA data centers to provide customized data products. A combination of grid technology and commodity processors are proposed to provide the bandwidth necessary to perform customized processing of data, with customized data subsetting providing the initial example. This customized subsetting engine can be used to support a new type of subsetting, called phenomena-based subsetting, where data is subsetting based on its association with some phenomena, such as mesoscale convective systems or hurricanes. This concept is expanded to allow the phenomena to be detected in one type of data, with the subsetting requirements transmitted to the subsetting engine to subset a different type of data. The subsetting requirements are generated by a data mining system and transmitted to the subsetter in the form of an XML feature index that describes the spatial and temporal extent of the phenomena. For this work, a grid-based mining system called the Grid Miner is used to identify the phenomena and generate the feature index. This paper discusses the value of grid technology in facilitating the development of a high performance customized product processing and the coupling of a grid mining system to support phenomena-based subsetting.

Author

NASA Programs; Grid Generation (Mathematics); Data Mining; Technology Utilization; Information Systems; Computer Systems Programs

63

CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also 54 *Man/System Technology and Life Support*.

20030066325 NASA Ames Research Center, Moffett Field, CA, USA

Automated Reasoning CICT Program/Intelligent Systems Project ATAC-PRT Review

Morris, Robert; Smith, Ben; May 20, 2003; 36 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy

An overview is presented of the Automated Reasoning CICT Program/Intelligent Systems project. Automated reasoning technology will help NASA missions by increasing the amount of science achieved, ensuring safety of spacecraft and surface explorers, and by enabling more robust mission operations.

CASI

Decision Support Systems; Knowledge Bases (Artificial Intelligence); Automatic Control; Computer Programs

20030066382 Nebraska Univ., Omaha, NE, USA

Intelligent Airport Gate Assignment System

Soi-Hoi, Lam; The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 2; July 2001; 9 pp.; In English; See also 20030066377; Copyright; Avail: CASI; [A02](#), Hardcopy

Aircraft-Gate Assignment Problem (AGAP) is a well-known NP-hard problem for optimization. In an airport, during daily airport operations the arrival and departure times of flights may vary compared to their original schedules. This may require reassignment of gates to capture the dynamics of flights and gate status to enhance the level of services provided to passengers. For busy airports with high number of arrivals/departures, the assignment decisions must be made within a short time to capture all the changes. To satisfy this requirement, a real-time intelligent airport gate assignment system is developed for this purpose for the management and assignment of gates at an airport for daily operations. The system is aimed at performing the gate assignment for every flight, taking into consideration of gate and flight dynamics, transfers, requirements of the airlines, aircraft types, airport operation rules, etc. In this paper, an intelligent system for airport gate assignment (InGates) is presented. The structure and special feature of the system is discussed, as well as applications to perform gate allocations to a set of data obtained from the Singapore's Changi Airport. The results show that InGates is able to allocate gates to aircrafts of flights in a reasonably large and busy airport within a short time. Together with systems and tools designed to allow for real-time adjustments to data and settings used by InGates, it has the capability to function as a real-time decision support system for airport gate assignment. The results obtained from the intelligent system module of InGates will be used as input to facilitate the search of an optimum solution for the airport gate assignment program as the next step of the development.

Derived from text

Airports; Commercial Aircraft; Systems Engineering; Airline Operations; Artificial Intelligence

20030067202 California Univ., Berkeley, CA

The Effect of External and Internal Noise on the Performance of Chaotic Neural Networks

Kozman, Robert; Freeman, Walter J.; Jan. 2002; 6 pp.; In English

Contract(s)/Grant(s): DAAH04-96-1-0341

Report No.(s): AD-A413501; ARO-35873.175-MA-MUR; No Copyright; Avail: CASI; [A02](#), Hardcopy

Biological evidence suggests that information encoding in the form of oscillatory patterns is advantageous compared to convergent fixed-point type memories. Freeman's KIII model is an example of operational chaotic memory neural networks. Noise plays a constructive role in the model by maintaining and stabilizing aperiodic orbits. Gaussian noise components are injected to the model different locations: at the input channels and also at a centrally located internal node. Depending on the noise intensity and bias, resonance effects have been identified in the KIII model. The observed noise effects have some similarity with stochastic resonance but there are very essential differences. The interaction of noise with the oscillatory signal has a resonance character in the KIII model. The oscillatory signal in KIII, however, is not coming from the external world, but it is the result of the interaction of various intern components. Therefore, the signal has an intimate interference with the noise. These effects are illustrated in pattern recognition problems.

DTIC

Neural Nets; Noise Intensity; Oscillations

20030067468

Validation of Agent Based Distillation Movement Algorithms

Gill, Andrew W.; Grieger, Dion; Jan. 2003; 39 pp.; In English; Original contains color illustrations

Report No.(s): AD-A414281; DSTO-TN-0476; DODA-AR-012-555; X5-X5; No Copyright; Avail: CASI; [A03](#), Hardcopy

Agent based distillations (ABD) are low-resolution abstract models, which can be used to explore questions associated with land combat operations in a short period of time. Movement of agents within the EINSTEIN and MANA ABDs is based on a simple attraction-repulsion weighting system and an associated numerical penalty function. The relative simplicity of these ABDs seems to have led to the general acceptance of their associated movement algorithms, without much validation or analysis of behaviour. This paper analyses these movement algorithms and finds unwanted behaviour, and proposes suggestions for improvement to the penalty function based on relative distances. A novel technique based on the concepts underlying spatial estimation is also proposed as an alternative.

DTIC

Algorithms; Operations Research; Proving

20030067473 Defence Science and Technology Organisation, Salisbury, Australia

Using Agent Based Distillations in Support of the Army Capability Development Process - A Case Study

Gill, Andrew W.; Egudo, Richard R.; Dortmans, Peter J.; Grieger, Dion; Dec. 2002; 35 pp.; In English; Original contains color illustrations

Report No.(s): AD-A414298; DSTO-TR-1378; DODA-AR-012-539; No Copyright; Avail: CASI; [A03](#), Hardcopy

In order to support its continuous modernization process, the Australian Army requires analytical Support in determining the effectiveness of their conceptual Enhanced Combat Force (set fifteen years ahead). Central to this is how new and emerging technologies might impact on how the land force operates, and, consequentially, how the Army's operational concepts might need to change. Agent Based Distillations (ABD) have been employed to analyse a problem based on Manoeuvre Operations in a Littoral Environment concept. Specifically, the hypothesis tested was whether a small, mobile force with high situational awareness coupled with effective reach-back munitions could defeat a significantly larger force. This paper illustrates the application of one such ABD, EINSTEIN, in support of the analysis of this hypothesis, and highlights the potential utility of ABDs for land operations analyses.

DTIC

Effectiveness; Situational Awareness; Combat; Investigation

20030067503 Brown Univ., Providence, RI

Numerical Methods in Stochastic Control

Kushner, Harold; Dupuis, Paul; Jul. 24, 2002; 5 pp.; In English

Contract(s)/Grant(s): DAAD19-99-1-0223

Report No.(s): AD-A414605; 4; AMSRL-RO-RI-39150.21-MA; No Copyright; Avail: CASI; [A01](#), Hardcopy

The second edition of our book 4 on numerical methods in stochastic control has appeared. The book and the methods

contained therein are now the standard in the field. It contains the most comprehensive development of numerical algorithms and associated convergence proofs for a large part of the current forms of stochastic control problems in continuous time. The PI's algorithms (and proof techniques) are the algorithms of choice for the bulk of continuous time stochastic control problems. In addition to the broad coverage of the first edition, it gives numerical algorithms and proofs for problems where the variance term is controlled, and for jump-diffusions where the jump is controlled. Important applications of jump control occur, for example, in communications theory. Consider, for example, a system where a server divides its time between several queues whose input processes are bursty, and the individual connections are subject to random breakdown or fading. The control problem is the scheduling of the server and this must be done continuously. A jump increase in the total system workload can occur when some connection breaks down or fades and the work in the available queues is less than the server can handle, but customers continue to arrive at the unavailable queues, so there is undesired idle time. The control policy affects the jump sizes. Traditional methods cannot handle such problems. The standard use of the Poisson measure driven model is no longer adequate, and a general theory is developed. Additionally, the book contains a thorough development of deterministic problems that arise in control and in the calculus of variations, and includes discontinuous or unbounded dynamical terms, with applications to image reconstruction, large deviations, and elsewhere. The algorithms are about the fastest and most stable available, and there are convergence proofs for all of them.

DTIC

Information Theory; Numerical Analysis; Stochastic Processes

64

NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20030066286

Number Theoretic Methods in Harmonic Analysis: Theory and Application

Casey, Stephen D.; May 31, 2002; 17 pp.; In English

Contract(s)/Grant(s): DAAD19-99-1-0240

Report No.(s): AD-A413800; OSP-LRW019901.1; ARO-40076.8-MA; No Copyright; Avail: CASI; [A03](#), Hardcopy

We have used tools from theory of harmonic analysis and number theory to extend existing theories and develop new approaches to problems. This work has focused on two areas. We have developed algorithms on extensions of Euclidean domains which have led to new computationally straightforward algorithms for parameter estimation for periodic point processes, and in particular, for sparse, noisy data. We have shown why Fourier analytic methods, e.g., Wiener's periodogram, do not produce maximum likelihood estimates for the sparse data sets on which our methods work. We are also working on extending our work to multiply periodic processes. We have also used the tools from multichannel deconvolution to develop a new procedure for multi-rate sampling. We have investigated applying these techniques to develop a new procedure for A-D conversion. We have also developed interlinked wavelet bases, interlinked via number-theoretic conditions that proved useful for both multi-channel deconvolution and multi-rate sampling. We have also created new procedures for sampling in radial domains which have application to radar and sonar. We have also extended these ideas to operator theory, creating sets of strongly coprime chirp and chirplet operators.

DTIC

Wavelet Analysis; Harmonic Analysis; Signal Processing; Fourier Analysis

20030066349 Tsinghua Univ., Beijing, China

Dipole Localization Method Based on the High-Resolution EEG

Xie, Y. Q.; Ma, X. S.; Oct. 25, 2001; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A412444; No Copyright; Avail: CASI; [A01](#), Hardcopy

The dipole localization method (DLM) of the electroencephalogram (EEG) is investigated based on the high-resolution EEG. The finite volume method (FVM)-boundary element method (BEM) coupled method is used for DLM. For FVM, a novel mesh generation method is presented to overcome the geometric singularity. This method can be employed to calculate EEG forward problems and extended to calculate the high-resolution EEG (HREEG). Because of the high spatial resolution of HREEG, as well as the merits of FVM and BEM, we can expect that the FVM-BEM coupled method is more accurate than the conventional DLM.

DTIC

Electroencephalography; High Resolution; Numerical Analysis; Position (Location); Dipoles

20030066362 NASA Glenn Research Center, Cleveland, OH, USA

Sub-problem Optimization With Regression and Neural Network Approximators

Guptill, James D.; Hopkins, Dale A.; Patnaik, Surya N.; June 2003; 18 pp.; In English

Contract(s)/Grant(s): WU 708-24-13

Report No.(s): NASA/TM-2003-210714; E-12667; NAS 1.15:210714; Copyright; Avail: CASI; [A03](#), Hardcopy

Design optimization of large systems can be attempted through a sub-problem strategy. In this strategy, the original problem is divided into a number of smaller problems that are clustered together to obtain a sequence of sub-problems. Solution to the large problem is attempted iteratively through repeated solutions to the modest sub-problems. This strategy is applicable to structures and to multidisciplinary systems. For structures, clustering the substructures generates the sequence of sub-problems. For a multidisciplinary system, individual disciplines, accounting for coupling, can be considered as sub-problems. A sub-problem, if required, can be further broken down to accommodate sub-disciplines. The sub-problem strategy is being implemented into the NASA design optimization test bed, referred to as 'CometBoards.' Neural network and regression approximators are employed for reanalysis and sensitivity analysis calculations at the sub-problem level. The strategy has been implemented in sequential as well as parallel computational environments. This strategy, which attempts to alleviate algorithmic and reanalysis deficiencies, has the potential to become a powerful design tool. However, several issues have to be addressed before its full potential can be harnessed. This paper illustrates the strategy and addresses some issues.

Author

Neural Nets; Design Optimization; Substructures; Sensitivity Analysis

20030066515 NASA Ames Research Center, Moffett Field, CA, USA

Generative Representations for Evolving Families of Designs

Hornby, Gregory S.; [2003]; 12 pp.; In English; Genetic and Evolutionary Computation Conference, 12-16 Jul. 2003, Chicago, IL, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy

Since typical evolutionary design systems encode only a single artifact with each individual, each time the objective changes a new set of individuals must be evolved. When this objective varies in a way that can be parameterized, a more general method is to use a representation in which a single individual encodes an entire class of artifacts. In addition to saving time by preventing the need for multiple evolutionary runs, the evolution of parameter-controlled designs can create families of artifacts with the same style and a reuse of parts between members of the family. In this paper an evolutionary design system is described which uses a generative representation to encode families of designs. Because a generative representation is an algorithmic encoding of a design, its input parameters are a way to control aspects of the design it generates. By evaluating individuals multiple times with different input parameters the evolutionary design system creates individuals in which the input parameter controls specific aspects of a design. This system is demonstrated on two design substrates: neural-networks which solve the 3/5/7-parity problem and three-dimensional tables of varying heights.

Author

Algorithms; Neural Nets; Coding

20030066898 NASA Marshall Space Flight Center, Huntsville, AL, USA

North Alabama Lightning Mapping Array (LMA): VHF Source Retrieval Algorithm and Error Analyses

Koshak, W. J.; Solakiewicz, R. J.; Blakeslee, R. J.; Goodman, S. J.; Christian, H. J.; Hall, J.; Bailey, J.; Krider, E. P.; Bateman, M. G.; Boccippio, D., et al.; [2003]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

Two approaches are used to characterize how accurately the North Alabama Lightning Mapping Array (LMA) is able to locate lightning VHF sources in space and in time. The first method uses a Monte Carlo computer simulation to estimate source retrieval errors. The simulation applies a VHF source retrieval algorithm that was recently developed at the NASA Marshall Space Flight Center (MSFC) and that is similar, but not identical to, the standard New Mexico Tech retrieval algorithm. The second method uses a purely theoretical technique (i.e., chi-squared Curvature Matrix Theory) to estimate retrieval errors. Both methods assume that the LMA system has an overall rms timing error of 50 ns, but all other possible errors (e.g., multiple sources per retrieval attempt) are neglected. The detailed spatial distributions of retrieval errors are provided. Given that the two methods are completely independent of one another, it is shown that they provide remarkably similar results. However, for many source locations, the Curvature Matrix Theory produces larger altitude error estimates than the (more realistic) Monte Carlo simulation.

Author

Lightning; Error Analysis; Monte Carlo Method; Computerized Simulation; Algorithms

20030067114 Academy of Sciences (USSR), Moscow, USSR

Estimations of Axial Moment of the Growing Earth

Pechernikova, G. V.; Davidenko, I. W.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

30 yrs of analytical modeling and numerical simulation have revealed two general stages in the terrestrial accretion process: 1) stage in which planetesimals experience runaway growth and form lunar-sized planetary embryos in approximately 10(exp 5) - 10(exp 6) years; and 2) final stage dominated by mutual gravitational perturbations between embryos, resulting in large, stochastic impact events and formation of the final terrestrial planets after about 10(exp 8) years. Recent dynamical models of lunar formation in the giant impact scenario have raised new complicating issues. It was shown that (a) the angular momentum of the Earth-Moon system could have resulted from more than one impact, (b) the moon-forming impact may not have been the last large impact on the Earth.

Derived from text

Estimating; Angular Momentum; Perturbation; Mathematical Models

20030067225 Colorado Univ At Boulder Dept. Of Applied Mathematics, Boulder, CO, USA

Nonlinear Wave Propagation

Ablowitz, Mark J.; Feb. 19, 2003; 14 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0031

Report No.(s): AD-A413512; 153-1989; AFRL-SR-AR-TR-03-0164; No Copyright; Avail: CASI; [A03](#), Hardcopy

Research investigations involving the nonlinear wave propagation that arise in physically significant systems have been carried out. Applications include modeling and computational studies of wave phenomena in nonlinear optics, solutions of physically significant nonlinear equations, chaotic wave dynamics in physical systems and inverse scattering. There have been a number of important research contributions. During the past three years 19 papers were published or accepted for publication in refereed journals, 4 book chapters were published or accepted, and 14 invited lectures were given. New methods to find solutions to discrete equations in a nonlinear optical fiber array were discovered. Discrete diffraction managed systems and associated solitons were proposed. This work is relevant to recent experiments involving discrete optical waveguides. Experimental arrays occupy 5 microns in width and a total length of 2-5 millimeters. From first principles, the equations governing discrete systems in nonlinear optical arrays as well as discrete diffraction managed systems have been derived. The concept of dispersion management is being applied to the study of ultra-short laser pulse dynamics in Ti:sapphire lasers. In quadratic nonlinear optical media, a vector system of nonlinear Schrodinger (NLS) type with coupling to a mean field has been derived. It has been established that a universal type of chaotic wave dynamics can develop in physical and computational systems. Parameter regimes have been delineated where chaotic dynamics are predicted and observed. Such chaotic dynamics has been shown to arise in computational chaos, water waves and short pulses in nonlinear optical fibers. A class of free boundary problems has been investigated. New classes of localized solutions to multidimensional nonlinear wave problems have been obtained and analyzed.

DTIC

Wave Propagation; Nonlinearity; Nonlinear Optics; Optical Waveguides

20030067227 University of Southern California, Los Angeles, CA

Stochastic Navier-Stokes Equations. Propagation of Chaos and Statistical Moments

Mikulevicius, R.; Rozovskii, B.; Jan. 2001; 11 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0418

Report No.(s): AD-A413558; ARO-38076.14-MA; No Copyright; Avail: CASI; [A03](#), Hardcopy

In the first part of the paper, we discuss existence and uniqueness results for a general stochastic-Navier-Stokes equation (SNS) derived from the first principles. In the second part, we deal with the propagation of Wiener chaos by the SNS and its relation to statistical moments of the solution.

DTIC

Stochastic Processes; Turbulence; Navier-Stokes Equation

20030067252 Naval Academy, Annapolis, MD

Survivability Modeling and Validation in Complex Rib-Skin Structures

Burkhardt, John; Joyce, Peter J.; Apr. 2003; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A413604; AIAA-2003-1470; No Copyright; Avail: CASI; [A02](#), Hardcopy

This paper presents a coordinated effort to model, test and validate the structural response of complex aerospace rib-skin structures in both undamaged and damaged configurations. Coordinated experimental and finite element model results are presented for cylindrical rib-skin structures each approximately nine foot long, and thirty inches in diameter. The test articles considered are of riveted aluminum construction and include internal structural components including bulkheads and complex stiffeners. Experimental reproduction of the highly idealized loading conditions used in the finite element models required the development of a custom loading rig that is described in detail. In summary, the finite element models were found to predict the structural stiffness of both the damaged and undamaged structures well for small deflections and strains. However, structural failure was not well predicted because large deflections and nonlinear material behavior were intentionally not modeled for simplicity.

DTIC

Finite Element Method; Bulkheads; Ribs (Supports)

20030067314 Air Force Research Lab., Edwards AFB, CA, USA

Modeling and Simulation of a Health Monitoring System in an Analog Motor

Miller, Tim; Ruderman, Greg; May 2003; 29 pp.; In English

Contract(s)/Grant(s): Proj-4847

Report No.(s): AD-A414570; AFRL-PR-ED-TP-2003-115; No Copyright; Avail: CASI; [A03](#), Hardcopy

Finite element modeling of a cross section of a solid rocket motor is used to determine the relationship between several variables in a health monitoring system. The system consists of pressure sensors mounted on the inner case wall. In a pressurized motor, differences among the sensor readings are indicative of crack growth in the propellant. The computational data is used to determine the relationship between sensor sensitivity, the number of sensors, and the minimum detectable crack size. The method of determining the relationships is applicable to other loading conditions, such as thermal loading.

DTIC

Solid Propellant Rocket Engines; Analogs

20030067358 Rensselaer Polytechnic Inst., Troy, NY

Adaptive and Parallel Computation for Transient Partial Differential Equations

Flaherty, Joseph E.; Shephard, Mark S.; Mar. 22, 2002; 13 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0200

Report No.(s): AD-A414489; ARO-37639.1-MA; No Copyright; Avail: CASI; [A03](#), Hardcopy

We have studied and developed procedures for the adaptive and parallel solution of transient partial differential equations. In particular, we concentrated on (i) techniques to manage distributed data, (ii) dynamic load balancing, (iii) discontinuous Galerkin schemes for hyperbolic systems, (iv) a posteriori error estimation strategies for discontinuous Galerkin methods, and (v) generalized mesh adaptation procedures. The resulting software is being applied to problems arising in several disciplines; however, it has been most successful with compressible fluid dynamics.

DTIC

Computation; Partial Differential Equations; Error Analysis; Dynamic Loads

20030067386 Cornell Univ., Ithaca, NY

Building Interactive Digital Libraries of Formal Algorithmic Knowledge

Constable, Robert L.; Jun. 2003; 13 pp.; In English

Contract(s)/Grant(s): N000014-01-1-0765

Report No.(s): AD-A414364; CU-CSD-TR-39544; No Copyright; Avail: CASI; [A03](#), Hardcopy

This is a project to design and create a software system for sharing formal algorithmic mathematics among theorem provers, and for making formal algorithmic mathematics accessible to people who value verified accounts of algorithms. The project is also committed to creating interesting specimens of formally explained algorithms. Our work enables a new approach to CIP/SW; we call it information-intensive infrastructure protection. We describe the rationale for this approach in this report.

DTIC

Algorithms; Computer Programs; Theorems

20030067484 Colorado State Univ., Fort Collins, CO

A Reductionist Approach to Process Discovery

Kirby, Michael; May 31, 2002; 8 pp.; In English

Contract(s)/Grant(s): F49620-99-1-0034

Report No.(s): AD-A414328; AFRL-SR-AR-TR-03-0180; No Copyright; Avail: CASI; [A02](#), Hardcopy

The primary objective of this research program is to develop and apply mathematical tools for the purposes of process discovery. Our focus is on empirically based methods applied to massive data sets in a high-dimensional setting. The emphasis of the program is on applications of direct interest to the Air Force. In particular, we have been investigating problems of interest to Air Force Research Laboratory, Materials & Manufacturing Directorate, Materials Process Design Branch at Wright Patterson Air Force base. Lately, we have intended the work to a problem of interest to the USA Forest Service. Recent work includes the application of subspace noise reduction methods and their connection to blind source separation. We have established a theoretical connection between the maximum noise fraction method and independent component analysis and demonstrated the relationship with examples. This methodology has proven useful as an integral component of the Whitney Reduction Network, developed by the grantees. Additionally, a new approach for designing support vector machines has been developed for the classification problem using a kernel based Fisher discriminant method. In addition we have developed other algorithms in terms of kernel functions using a kernel Grim-Schmidt algorithm. These techniques have been applied to the materials science bonding problem.

DTIC

Research Projects; Mathematical Models; Signal Processing; Transformations (Mathematics)

20030067506 Boise State Univ., Boise, ID, USA

MODFLOW-2000 for Cylindrical Geometry With Internal Flow Observations and Improved Water Table Simulation

Clemo, Tom; Aug. 2002; 34 pp.; In English

Contract(s)/Grant(s): DAAD19-00-1-0454; DAAH04-96-1-0318

Report No.(s): AD-A414477; BSU-CGISS-02-01; ARO-35802.27-EV-RSP; No Copyright; Avail: CASI; [A03](#), Hardcopy

A modified form of the MODFLOW-2000 code provides a tool to estimate a hydraulic conductivity distribution near a borehole. The modified code allows the effects of wellbore screen intervals, screen clogging, and disturbed zone skin to be taken into account. The primary application has been in an investigation of electromagnetic borehole flow meter measurement interpretation. MODFLOW-2000 was modified to simulate a two-dimensional cylindrical geometry. The two dimensions are vertical and radial with angular symmetry. The geometry is similar to the RADMOD preprocessor to MODFLOW, but is more flexible in that the grid spacing in the radial direction may be non-regular and the hydraulic conductivity of a layer need not be constant. This modification includes sensitivity calculations so that parameter estimation can be performed. To support parameter estimation using flow meters, a new measurement category of internal flow observations was introduced. Internal flow observations occur at locations that are fully contained within the model domain. The standard MODFLOW-2000 code is limited to flow observations across the model domain boundaries. The new internal flow measurement observations are compatible with the normal MODFLOW-2000 Cartesian geometry and with the cylindrical geometry modifications. A third modification moves the node location of a cell containing the water table from the center of the cell to the location of the water table. The vertical position of the node dynamically follows changes in the water table position. This change improves the simulation of water table dynamics for both cylindrical geometry and Cartesian geometry simulations. Together these modifications provide a tool for modeling pumping from a wellbore with multiple screened zones in a layered aquifer with an azimuthally uniform disturbed zone. If the wellbore is included, the pumping rate can be applied to the upper node of the wellbore.

DTIC

Water Tables; Electromagnetic Measurement; Simulation

20030067522

2002 International Conference on Mathematical Methods in Electromagnetic Theory (MMET 02). Volume 2

Sep. 2002; 346 pp.; In English

Contract(s)/Grant(s): F61775-02-WF065; N62558-02-M-6003

Report No.(s): AD-A413455; R/D-9294-EE-02; No Copyright; Avail: CASI; [A15](#), Hardcopy

Conference proceedings of the 2002 International Conference on Mathematical Methods in Electromagnetic Theory, Volume 2, held in Kiev, Ukraine, 10-13 September 2002. Table of Contents, Volume 2: Wiener-Hopf and Function-Theoretic Methods; Gratings and Frequency-Selective Surfaces; Antenna Analysis and Synthesis; Numerical Techniques; Scattering and

Radar Cross Section; Waveguide Circuits; Composite Media and Metamaterials; Analytical Regularization; Propagation and Signal Processing; Beams and Plasmas; Eigenvalue Problems.

DTIC

Electromagnetism; Mathematical Models; Selective Surfaces; Plasmas (Physics); Signal Processing

20030067566 NASA Langley Research Center, Hampton, VA, USA

Strategy-Enhanced Interactive Proving and Arithmetic Simplification for PVS

diVito, Ben L.; Design and Application of Strategies/Tactics in Higher Order Logics; September 2003, pp. 43-55; In English; See also 20030067561; No Copyright; Avail: CASI; [A03](#), Hardcopy

We describe an approach to strategy-based proving for improved interactive deduction in specialized domains. An experimental package of strategies (tactics) and support functions called Manip has been developed for PVS to reduce the tedium of arithmetic manipulation. Included are strategies aimed at algebraic simplification of real-valued expressions. A general deduction architecture is described in which domain-specific strategies, such as those for algebraic manipulation, are supported by more generic features, such as term-access techniques applicable in arbitrary settings. An extended expression language provides access to subterms within a sequent.

Author

Theorem Proving; Computer Programming; Analysis (Mathematics)

20030067567 Cambridge Univ., Cambridge, UK

First-Order Proof Tactics in Higher-Order Logic Theorem Provers

Hurd, Joe; Design and Application of Strategies/Tactics in Higher Order Logics; September 2003, pp. 56-68; In English; See also 20030067561; No Copyright; Avail: CASI; [A03](#), Hardcopy

In this paper we evaluate the effectiveness of first-order proof procedures when used as tactics for proving subgoals in a higher-order logic interactive theorem prover. We first motivate why such first-order proof tactics are useful, and then describe the core integrating technology: an LCFstyle logical kernel for clausal first-order logic. This allows the choice of different logical mappings between higher-order logic and first-order logic to be used depending on the subgoal, and also enables several different first-order proof procedures to cooperate on constructing the proof. This work was carried out using the HOL4 theorem prover; we comment on the ease of transferring the technology to other higher-order logic theorem provers.

Author

Kernel Functions; Theorem Proving

65

STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20030066984 California Univ., Berkeley, CA

Statistical Problems in Remote Sensing, Image Compression, and Mapping of Human Chromosomes

Yu, Bin; May 20, 2002; 7 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0341

Report No.(s): AD-A413806; ARO-36606.18-MA; No Copyright; Avail: CASI; [A02](#), Hardcopy

Research findings were obtained on Minimum Description Length (MDL) principle and its applications, on microarray image compression and data analysis, and on classifications based on hyperspectral measurements in remote sensing.

DTIC

Remote Sensing; Image Analysis; Chromosomes

20030067233 Toyon Research Corp., Goleta, CA

Generalized Linear Mixed-Effects Models in R

Juricek, Ben C.; Feb. 2003; 72 pp.; In English

Contract(s)/Grant(s): DAMD17-02-C-0119

Report No.(s): AD-A413561; No Copyright; Avail: CASI; [A04](#), Hardcopy

The Nonlinear and Linear Mixed-Effects (NLME) package for the open source statistical software system R provides an effective and efficient way to analyze longitudinal data collected from nested groups of subjects when the response of interest

is on a continuous scale. It does not provide methods for analyzing binary, multinomial, or ordinal responses, where a general linear mixed-effects model (GLMM) is required. We enhanced an existing R implementation for estimating a GLMM, which can estimate an approximate model using a crude numerical procedure. The R code was rewritten to take advantage of the best available numerical methods and the latest theoretical developments. Using simulated data sets, we demonstrate that the enhanced code is much faster and numerically robust. We propose an approach for modeling ordinal and multinomial data, the theory of which is less well developed than that of binomial data. The proposed approach is demonstrated using simulated and real data sets. The results illustrate the limits of the approximate procedure used in Phase I, which motivates the use of a more refined numerical method in Phase II.

DTIC

Data Bases; Nonlinearity; Numerical Analysis; Binomials

20030067266 Pennsylvania State Univ., University Park, PA

Modeling of Radiation from High Temperature Chemically Reacting Flows

Levin, Deborah A.; Gimelshein, Sergey; Collins, Robert; Benson, Craig; Alexeenko, Alima; Jan. 28, 2002; 7 pp.; In English
Contract(s)/Grant(s): DAAG55-98-1-0236

Report No.(s): AD-A413685; ARO-P-38700.8-EG-SD1; No Copyright; Avail: CASI; [A02](#), Hardcopy

The interaction of a jet from a 60-lbf thruster positioned on the side of a small rocket, using the direct simulation Monte Carlo method (DSMC) was applied to model the three-dimensional jet-atmosphere interaction. Chemical reactions between free stream and plume species were included in the simulations. Altitudes of 80 to 160 km and velocities of 3, 5 and 8 km/sec were considered. Chemical reactions between free stream and plume species were included in the simulations. Both uniform and non-uniform conditions were used at the thruster exit. A Navier-Stokes solver was used to calculate flow inside the thruster and in the near field of the plume. A two-stage DSMC numerical strategy was then used to calculate the plume, with sequential computations of an axisymmetric plume coreflow and three-dimensional plume-freestream interaction. The impact of rocket velocity and altitude on the plume-atmospheric interaction in terms of species produced by chemical reactions that can contribute to UV and MWIR radiation was examined. The UV radiation due to the NO and OH species has been computed and is sufficiently high such that an imager filtered to the 250 and 310 nm pass bands would be able to detect this radiation. These methodology is now being applied to generic cases related to the Miniaturized Kill Vehicle (MKV).

DTIC

Ultraviolet Radiation; Rocket Engines; Chemical Reactions

20030067344 Naval Undersea Warfare Center, Newport, RI

QSIM: A Queueing Theory Model with Various Probability Distribution Functions

Sullivan, Keith M.; Grivell, Ian; Mar. 14, 2003; 52 pp.; In English; Original contains color illustrations

Report No.(s): AD-A414471; NUWC-NPT-TD-11418; No Copyright; Avail: CASI; [A04](#), Hardcopy

QSIM is a queueing theory model developed to interpret the various undertakings involved in military operations. The multiple probability distribution functions (PDFs) for arrival, service, and renege rates not only allow QSIM to analyze a variety of specific warfare tasks (especially those characterized by nonexponential PDFs), but they also ensure that the model is applicable to many other situations. Moreover, the relatively efficient run times permit the user to analyze a range of input values quickly.

DTIC

Probability Distribution Functions; Queueing Theory; Computer Programs

20030067396 Engineering Research and Consulting, Inc., Edwards AFB, CA, USA

Internal Energy Mode Relaxation in High Speed Continuum and Rarefied Flows

Josyula, Eswar; Wadsworth, Dean C.; May 7, 2003; 20 pp.; In English

Contract(s)/Grant(s): F04611-99-C-0025; Proj-2308

Report No.(s): AD-A414578; AFRL-PR-ED-AB-2003-123; No Copyright; Avail: CASI; [A03](#), Hardcopy

The presence of shock waves in high speed flow of a polyatomic gas presents considerable difficulties for accurate numerical simulation of the flowfield. The shock wave redistributes the high kinetic energy of the oncoming flow into various internal energy modes, which relax relatively slowly, leading to significant chemical and thermal nonequilibrium the stagnation region. In the gas kinetic description, intermolecular collisions change the translational, rotational, vibrational, and electronic energies of the collision partners. The probabilities or effective cross sections of these elementary processes differ significantly giving rise to widely separate relaxation times for the internal modes. Thus it becomes important to account for

the rates of relaxation processes to predict the nonequilibrium behavior of these kinds of flows. The continuum description is well suited at lower altitudes of the flight regime for the prediction of aerodynamic loads and heating rates on the thermal protection systems. However at high altitudes and associated low densities the larger mean free path invalidates the continuum assumption and the rarefied solution approaches are necessary. Among the solution approaches in hypersonic rarefield of Direct Simulation Monte Carlo (DSMC) method is widely used.

DTIC

Polyatomic Gases; Chemical Reactions; High Energy Interactions; Flow Distribution

20030067422 George Mason Univ., Fairfax, VA

Final Report on Massive Data Sets: Visualization and Analysis

Wegman, Edward J.; May 8, 2002; 12 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0404

Report No.(s): AD-A414241; ARO-098056; No Copyright; Avail: CASI; [A03](#), Hardcopy

This project argued that the downsizing of U.S. Army implies a profound change in the way the Army carries out its war-fighting mission. There will be an increased reliance on technology. Because these are technology based warfare areas, there will be massive data sets generated electronically as part of the normal operations. The ability to analyze such data sets is crucial to the prosecution of a military engagement in 2000 and beyond since it is in the structure of these data sets that crucial information about the timing, size and nature of enemy attacks is likely to be found. We have developed several methods for carrying out the analysis of massive data sets, in particular we have carried out research to reduce the computational complexity of clustering algorithms, to reduce the complexity of visualization methods and to increase the ability of visualization methods to handle massive data sets, and research on quantization methods for massive data sets.

DTIC

Information Retrieval; Data Management; Data Mining; Scientific Visualization

20030067482 Michigan Univ., Ann Arbor, MI

The Adaptive Design of Experiments and Markovian Models

Woodroffe, Michael; May 2002; 5 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0482

Report No.(s): AD-A414376; ARO-37139.14-MA; No Copyright; Avail: CASI; [A01](#), Hardcopy

Research was conducted in three broad areas: setting confidence intervals following an adaptive or sequential experiment; central limit theory for sums of stationary processes; the monotone change problem and related problems in isotonic inference. For the confidence intervals existing techniques were extended to include grouped sequential methods and to allow for nuisance parameters. The work on central limit theory emphasized state space models (iterated random functions) and non-linear functionals of a linear process. In both cases, asymptotic distributions were obtained under very mild continuity conditions on the function or functional that is summed. The central limit theory was used to obtain the limiting distribution of a new test statistic in the context of a change point problem. For this the change point problem was reformulated to allow several gradual changes, as opposed to the single abrupt change implicit in the classical change point problem. The related problems in isotonic inference include a novel suggestion for the appropriate 'degrees of freedom' in an isotonic regression problem.

DTIC

Experiment Design; Optimization

20030067528 Lockheed Martin Tactical Defense Systems, Saint Paul, MN, USA

Multitarget Moments and their Application to Multitarget Tracking

Mahler, Ronald; Jan. 2001; 34 pp.; In English

Contract(s)/Grant(s): DAAG55-98-C-0039

Report No.(s): AD-A414365; ARO-37629.12-EL; No Copyright; Avail: CASI; [A03](#), Hardcopy

The concept of a 'statistical moment' has played a fundamental role in practical single-target tracking. The optimal tracking approach, the recursive Bayes filter, propagates the entire posterior density through time. Because this filter is computationally daunting, most practical single-target tracking approaches assume that signal-to-noise ratio is large enough that the posterior is approximately characterized by its low-order moments. For example, the alpha-beta-gamma filter propagates the first-order moment (the posterior expectation) whereas the extended Kalman filter (EKF) additionally propagates a second-order moment (the posterior covariance). Until recently, the possibility of an analogous multitarget

approach seems to have been ignored---apparently for lack of a systematic statistical foundation for multitarget problems. In two recent papers, I introduced multitarget moment statistics of arbitrary order and developed a Bayes filtering theory for the first-order multitarget moment, the 'probability hypothesis density (PHD). ' In this paper I continue this line of investigation. I will describe a preliminary implementation of the first-order filter. I will introduce the concept of multitarget posterior covariances of arbitrary order. Using them, I will show how a suitable extension of the finite-set statistics (FISST) multisensor-multitarget differential calculus can be used to construct multitarget statistical analogs of the EKF.

DTIC

Targets; Tracking (Position); Bayes Theorem

66

SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20030066264 Newcastle-upon-Tyne Univ., Newcastle

Cognitive Approach to Safe Violations

Besnard, D.; Greathead, D.; 2002; 24 pp.; In English

Report No.(s): PB2003-105206; CS-TR-776; Copyright; Avail: National Technical Information Service (NTIS)

Classically, humans have been perceived as a source of faults in systems. Modern ergonomic views are promoting a somewhat different idea according to which humans are a factor of safety in unexpected situations. The safety of a system cannot be achieved without taking into account these two sides of cognition which compose what is called cognitive flexibility. In this paper, the authors will consider the cases of a nuclear accident and a plane crash-landing where human cognitive flexibility has impacted on the final safety of the system. The authors aim to discuss the violations that humans have performed in these cases with the assumption that they do not always deteriorate system safety. The discussion gravitates around a core argument according to which violations per se do not inform on the safety impairments in a system. Some other dimensions have been taken into account. Among these, the authors are of the opinion that the accuracy of the operators' mental model plays a key role, allowing some violations to improve system safety in emergency situations.

NTIS

Human Factors Engineering; Human Performance; Safety Factors

20030067428 Massachusetts Univ., Lowell, MA

Optimization of Communication in Noisy Quantum Channels

Ruskai, Mary Beth; Sep. 30, 2002; 17 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0374

Report No.(s): AD-A413565; 005; ARO-38814.5-PH; No Copyright; Avail: CASI; [A03](#), Hardcopy

When quantum particles are used to transmit or process information, noise will affect the fidelity of the transmission. This project has been concerned with the analysis of mathematical models of noise for qubit channels, with the capacity of qubit channels used to transmit classical information, and with exchange errors in quantum computation. Some results were also obtained on adiabatic quantum computation.

DTIC

Optimization; Information Theory; Quantum Computation

20030067628 CH2M HILL Hanford Group, Inc., Richland, WA, USA

Sub-System and Component Level Safety Classification Evaluation and Identification for Tank Farm Safety Systems

Janicek, G. P.; Oct. 02, 2001; 94 pp.; In English

Report No.(s): DE2003-807460; RPP-3792; No Copyright; Avail: Department of Energy Information Bridge

The primary purpose of this document is to capture the rationale used in determining the safety classification of Tank Farm systems, structures, and components (SSCs) below the level of their parent Safety SSC as identified in the Tank Farms Final Safety Analysis Report (FSAR). The intended working purpose is for all necessary and sufficient information be incorporated herein to (1) justify the safety classifications assigned, (2) enable understanding of the safety functions thus defined for any subsequent design or equipment changes, and (3) as an aid in determining the level of qualification control required for operation, maintenance, and field replacement.

NTIS

Safety; Systems Engineering; Radioactive Wastes; Classifications

THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20030067203 Duke Univ., Durham, NC

Box-Trees and R-Trees With Near-Optimal Query Time

Agarwal, Pankaj K.; Berg, Mark de; Gudmundsson, Joachim; Hammar, Mikael; Haverkort, Herman J.; Jun. 5, 2001; 10 pp.; In English

Contract(s)/Grant(s): DAAH04-96-1-0013

Report No.(s): AD-A413493; No Copyright; Avail: CASI; [A02](#), Hardcopy

A box-tree is a bounding-volume hierarchy that uses axis-aligned boxes as bounding volumes. The query complexity of a box-tree with respect to a given type of query is the maximum number of nodes visited when answering such a query. We describe several new algorithms for constructing box-trees with small worst-case query complexity with respect to queries with axis-parallel boxes and with points. We also prove lower bounds on the worst-case query complexity for box-trees which show that our results are optimal or close to optimal. Finally, we present algorithms to convert box-trees to R-trees, resulting in R-trees with (almost) optimal query complexity.

DTIC

Topology; Algorithms; Trees (Mathematics)

20030067209 North Carolina State Univ., Raleigh, NC, USA

A Numerical Method for Heat Equations Involving Interfaces

Shen, Yun-Qiu; Li, Zhilin; May 2003; 11 pp.; In English

Contract(s)/Grant(s): DAAD19-99-1-0189

Report No.(s): AD-A413525; ARO-39676.3-MA; No Copyright; Avail: CASI; [A03](#), Hardcopy

In 1993, Li and Mayo gave a finite-difference method with second order accuracy for solving the heat equations involving interfaces with constant coefficients and discontinuous sources. Proc. Symp. Appl. Math. Vol. 48, W. Gautschi ed., AMS, 1993, p 311-315. In this paper, we improve the above result by presenting a finite-difference method which allows each coefficient to be taken different values in different subregions divided by the interface, that is useful in applications. Our method also has second order accuracy.

DTIC

Thermodynamics; Numerical Analysis; Finite Difference Theory; Methodology

20030067217 Duke Univ., Durham, NC

On Levels in Arrangements of Lines, Segments, Planes, and Triangles

Agarwal, Pankaj K.; Aronov, Boris; Sharir, Micha; Jan. 1997; 9 pp.; In English

Contract(s)/Grant(s): DAAH04-96-1-0013

Report No.(s): AD-A413624; No Copyright; Avail: CASI; [A02](#), Hardcopy

We consider the problem of bounding the complexity of the k -th level in an arrangement of n curves or surfaces, a problem dual to, and extending the well-known k -set problem. (a) We review and simplify some old proofs in new disguise and give new proofs of the bound $O(n \sqrt{k+1})$ for the complexity of the k -th level in an arrangement of n lines. (b) We derive an improved version of Lovasz Lemma in any dimension, and use it to prove a new bound, $O(n^{2k/3})$, on the complexity of the k -th level in an arrangement of n planes in the set of real numbers⁽³⁾, or on the number of k -sets in a set of n points in three dimensions. (c) We show that the complexity of any single level in an arrangement of n line segments in the plane is $O(n^{3/2})$, and that the complexity of any single level in an arrangement of n triangles in 3-space is $O(n^{17/6})$.

DTIC

Combinatorial Analysis; Geometry; Triangles; Complexity

20030067221 Duke Univ., Durham, NC

On the Complexity of Many Faces in Arrangements of Circles

Agarwal, Pankaj K.; Aronov, Boris; Sharir, Micha; Jan. 2002; 10 pp.; In English

Contract(s)/Grant(s): DAAH04-96-1-0013

Report No.(s): AD-A413626; No Copyright; Avail: CASI; [A02](#), Hardcopy

We obtain improved bounds on the complexity of m distinct faces in an arrangement of n circles and in an arrangement of n unit circles. The bounds are worst-case tight for unit circles, and, for general circles, they nearly coincide with the best known bounds for the number of incidences between m points and n circles.

DTIC

Circles (Geometry); Topology; Combinatorial Analysis; Complexity

20030067235 Northeastern Univ., Boston, MA

Nonlinear Adaptive Control of AC Electric Drives

Tadmor, Gilead; Stankovic, Aleksandar; Mar. 31, 2002; 11 pp.; In English

Contract(s)/Grant(s): DAAD19-99-1-0145

Report No.(s): AD-A413571; ARO-38975.44-C1; No Copyright; Avail: CASI; [A03](#), Hardcopy

The use of energy dynamics/dissipative design is one unifying theme for the various projects carried under this grant, exploring the scope of quadratically dissipative design, design based on shaping Hamiltonian dynamics and design for systems with non-quadratic energy structures. Specific projects involved the permanent magnet synchronous, switch reluctance, induction and DC motors, power electronics devices, including a three phase synchronous rectifiers, the series resonant converter, voltage source inverters, and power distribution systems. Projects involving electric motors ranged from a basic dissipativity based controller, to modeling and adaptive attenuation of torque ripple, and observer based shaft sensorless control for dynamic speed tracking. Concepts of nonlinear dissipative control and observer design were also studied in a fluidic turbulent system that features nonquadratic non linearities and Hamiltonians.

DTIC

Electric Motors; Nonlinear Systems; Adaptive Control; Alternating Current

20030067345 California Univ., San Diego, La Jolla, CA

Invariants for Multiple Qubits: The Case of 3 Qubits

Meyer, David A.; Wallach, Noland; Jan. 2002; 11 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0376; DAAD19-01-1-0520

Report No.(s): AD-A414438; No Copyright; Avail: CASI; [A03](#), Hardcopy

The problem of quantifying entanglement in multiparticle quantum systems can be addressed using techniques from the invariant theory of Lie groups. We briefly review this theory, and then develop these techniques for application to entanglement of multiple qubits.

DTIC

Group Theory; Lie Groups; Quantum Theory

20030067477 Massachusetts Inst. of Tech., Cambridge, MA

Adaptive Control of Nonlinearly Parametrized Systems

Annaswamy, Anuradha M.; Mar. 2002; 23 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0235

Report No.(s): AD-A414371; ARO-36438.5-CI; No Copyright; Avail: CASI; [A03](#), Hardcopy

This project pertains to the development of a theory for adaptive control of nonlinear dynamic systems that are nonlinearly parameterized (NLP). Developments in NLP systems that have been carried out as a part of this project relax the ubiquitous assumption made in the context of adaptive control which is that the unknown parameters occur linearly. During the past year, we have derived several new results related to NLP systems, and can be grouped under two categories: (I) Control of nonlinear systems with a triangular structure, (ii) Parameter convergence in NLP systems. The class of systems considered in (i) includes high-dimensional nonlinear systems connected in chain and triangular forms, examples of which include Hammerstein-Uryson models and recurrent neural networks. Global stabilization and tracking can be guaranteed for such systems in the presence of unknown parameters that occur nonlinearly. The results related to (ii) pertain to conditions of persistent excitation (PE) under which parameter convergence occurs in a class of discrete and continuous NLP systems. It is shown that for different classes of transcendental functions, distinct PE conditions can be derived that guarantee parameter convergence. Applications to parameter estimation in sigmoidal functions and identification of unknown frequencies of a sinusoidal signal are presented.

DTIC

Nonlinear Systems; Adaptive Control; Neural Nets

20030067551 Tsentralni Aerogidrodinamicheskii Inst., USSR

Some Basic Laws of Isotropic Turbulent Flow

Loitsianskii, L. G.; September 1945; 37 pp.; In English

Report No.(s): NACA-TM-1079; No Copyright; Avail: CASI; [A03](#), Hardcopy

An Investigation is made of the diffusion of artificially produced turbulence behind screens or other turbulence producers. The method is based on the author's concept of disturbance moment as a certain theoretically well-founded measure of turbulent disturbances.

Author

Turbulent Flow; Mathematical Models

20030067671 Newcastle-upon-Tyne Univ., Newcastle

Formalizing Design Patterns; A Case Study of the Iterator

Alfoudari, S.; Steggles, L. J.; Feb. 2003; 46 pp.; In English

Report No.(s): PB2003-105167; CS-TR-767; Copyright; Avail: National Technical Information Service (NTIS)

The authors investigate using algebraic methods and the support tool Maude to formally specify and reason about the well known iterator design pattern. The authors begin by specifying instances of the iterator pattern which can be described equationally using Maude. The authors then develop an abstract specification which they argue captures the essence of the iterator pattern. The authors conclude by specifying a possible refinement for iterator instances, a so called filter refinement, and by formally proving that this refinement is correct with respect to the authors' abstract specification.

NTIS

Algebra; Iteration; Patterns; Design

70

PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography*; for geophysics, astrophysics, or solar physics see *46 Geophysics*, *90 Astrophysics*, or *92 Solar Physics*.

20030066276

MEMS-Based Miniature X-Band Phase Shifters

Brown, Andrew R.; Sep. 2002; 18 pp.; In English

Contract(s)/Grant(s): F19628-00-C-0037; Proj-ARPS

Report No.(s): AD-A413682; AFRL-SN-HS-TR-2003-015; No Copyright; Avail: CASI; [A03](#), Hardcopy

The focus of this work was to drive the size and insertion loss of MEMS based phase shifters to an absolute minimum. The work is based on single pole, 4-throw (SP4T) MEMS switches. These novel switches were then applied on the development of low-loss, miniature 2-bit and 4-bit phase shifters. All designs are carried out on 8-mil thick GaAs substrates, a similar substrate typically used for X-band amplifier designs. Measurements indicate an insertion loss of -0.6 dB at 10 GHz for the 2-bit design, and excellent linear phase response and return loss from DC to 18 GHz. The chip area is 9.6 mm², and is the smallest reported to-date. The 2-bit phase shifter performed well from DC-18 GHz, with -0.8dB insertion loss at 18 GHz and a return loss of <-10.5 dB over DC-18 GHz. The 4-bit phase shifter based on SP4T switches resulted in a measured average insertion loss of -1.1 dB at 10 GHz, and a linear phase shift response from DC to 18 GHz. The chip area is 21 mm². This is the highest performing 4-bit phase shifter to-date at X-band, using any technology.

DTIC

Phase Shift; Microelectromechanical Systems; Superhigh Frequencies

20030066446 Technische Univ., Delft, Netherlands

Scattering & Absorption by Multiple Spherical Particles

Rommen, A. A. P.; Apr. 1999; 80 pp.; In English

Report No.(s): PB2003-104785; ET/EM-1999-05; Copyright; Avail: National Technical Information Service (NTIS)

Electromagnetic scattering by spheres has been of great interest to scientists for many years. The first electromagnetic scattering solution for a single sphere was obtained by Mie in 1908, which was 35 years after Maxwell formulated the fundamental equations of electromagnetic wave theory. For one spherical particle, a mathematical closed form solution exists which is exact. This solution is denoted as the Mie series. Once the authors introduce more spheres, one could imagine that

all the interactions between all these particles have to be included in the calculation of the resulting electromagnetic field.
NTIS

Electromagnetic Scattering; Spheres; Mie Scattering

20030067258 Army Armament Research, Development and Engineering Center, Watervliet, NY

Fatigue and Hydrogen Cracking in Cannons With Mechanical and Thermal Residual Stresses

Underwood, J. H.; Parker, A. P.; Troiano, E.; Vigilante, G. N.; Witherell, M. D.; Apr. 2003; 16 pp.; In English

Report No.(s): AD-A413678; ARCCB-TR-03005; No Copyright; Avail: CASI; [A03](#), Hardcopy

Bauschinger-modified autofrettage residual stresses are used to improve the fatigue intensity factor model for fatigue life of cannon pressure vessels. Effects of yield strength and initial crack size are included with applied and residual stress. In an S-N description of cannon tube life that matches full-scale cannon fatigue test results with an R2 correlation of 0.92. Thermally induced residual stress near the bore of a fired cannon is modeled by finite-difference calculations of temperature and mechanics calculations of transient thermal stress and resulting residual stress. Temperature-dependent thermal and physical properties are used, and the temperature distributions are validated by direct comparison with the known temperatures and the observed depths of microstructural damage and transformation in fired cannons. Calculations of fatigue life and yield pressure for a range of applied pressure, diameter ratio, yield strength, and percent autofrettage agree well with measurements from full-scale cannons. Increased life is predicted for increases in yield strength and percent autofrettage, although the Bauschinger effect significantly reduces the amount of life Increase for autofrettage above 50%. The combined effects of mechanically Induced residual stress and thermally induced residual stress on cannon fatigue life are calculated, using an Increased initial crack size to account for thermal residual stress. Calculations of fatigue life are presented for a range of applied pressure and for selected gas temperatures.

DTIC

Crack Propagation; Residual Stress; Pressure Vessels

20030067339 Naval Undersea Warfare Center, Newport, RI

A Method for Estimating the Mechanical Properties of a Solid Material Subjected to Significant Compressional Forces - Part I: Numerical Theoretical Solution for a Single Thick Plate

Hull, Andrew J.; Feb. 10, 2003; 47 pp.; In English

Report No.(s): AD-A413814; NUWC-NPT-TR-11; 412; No Copyright; Avail: CASI; [A03](#), Hardcopy

13 ABSTRACT (Maximum 200 words) This report develops a technique for measuring (or estimating) the complex frequency-dependent dilatational and shear wavenumbers of a single slab of material subjected to large static compressional forces. The method employs two transfer functions that are obtained by vibrating the mass-loaded material in both the vertical and horizontal directions. Once this process is accomplished, the transfer functions are merged with a theoretical model and displayed as analytical surfaces from which the dilatational and shear wavenumbers can be identified and estimated. These wavenumbers are then combined to determine complex dilatational wavespeed, complex shear wavespeed, complex Lamb constants, complex Young's modulus, complex shear modulus, and complex Poisson's ratio,

DTIC

Mechanical Properties; Estimating; Thick Plates

20030067341 Army Armament Research, Development and Engineering Center, Watervliet, NY

Experimental Data, Numerical Fit, and Fatigue Life Calculations Relating to the Bauschinger Effect in High-Strength Armament Steels

Troiano, Edward; Parker, Anthony P.; Underwood, John; Mossey, Charles; Apr. 2003; 19 pp.; In English

Report No.(s): AD-A414463; ARCCB-TR-03006; No Copyright; Avail: CASI; [A03](#), Hardcopy

The uniaxial Bauschinger effect has been evaluated in several high strength steels being considered for armament use. Tests were conducted at plastic strains up to 3.5%. Results of testing show a progressive decrease in Bauschinger effect up to plastic strains of approximately 1% (for all materials investigated), after which there is little further decrease.

DTIC

Bauschinger Effect; Fatigue Life; High Strength Steels; Data Acquisition; Experimentation

20030067352 Rutherford Appleton Lab., Chilton

Particle Physics Experiments Report 2002

Feb. 2003; 386 pp.; In English

Report No.(s): PB2003-105147; RAL-TR-2003-006; Copyright; Avail: National Technical Information Service (NTIS)

This report describes work carried out in 2002 on experiments approved by the Particle Physics Experiments Selection Panel. The contents consist of unedited contributions from each experiment.

NTIS

Elementary Particles; High Energy Interactions

20030067388 Materials Research Society, Warrendale, PA

Symposium Q: Magnetoelectronics - Novel Magnetic Phenomena in Nanostructures

Schuller, Ivan K.; Guntherodt, Gernot; Kent, Andrew D.; Shinjo, Teruya; Dec. 2002; 16 pp.; In English

Contract(s)/Grant(s): N00014-03-1-0202

Report No.(s): AD-A414604; No Copyright; Avail: CASI; [A03](#), Hardcopy

The area of anisotropic magnetotransport in magnetic superlattices remains controversial and intensely investigated by theorists and experimentalists, as demonstrated in Symposium Q on Magnetoelectronics-Novels Magnetic Phenomena in Nanostructures. The main issues that were highlighted are the importance of mean free path, the connection between structure and GMR, and whether GMR originates from the bulk or interface in the superlattice, especially in experiments in which the current flows perpendicular to the interfaces. B.J. Hickey (Leeds Univ.) said, based on experiments in Permalloy-containing superlattices, that the mean free path is crucial in determining the GMR. Theoretical work (P. Weinberger, Univ. of Vienna) seems to show that in the Fe/Cr interface, scattering originates in the interface in agreement with experimental claims (J. Santamaria, Univ. of Madrid, Spain). The magnetic proximity effect, while an old subject, has received renewed attention from experimentalists and theorists who are principally motivated by the developments in spintronics. M. Kiwi (Catholic Univ., Chile) summarized the long history of this field. Generally, it is accepted and found experimentally (A. Hoffmann, ANL) that the magnetic proximity effect is small and confined to a very short distance close to the interface. A novel type of proximity effect was predicted theoretically (L.J. Sham, UCSD) in which electrons in a semiconductor become polarized if reflected from an interface with a magnetic material.

DTIC

Magnetic Fields; Superlattices; Magnetic Effects; Nanostructures (Devices)

20030067401 New Mexico Inst. of Mining and Technology, Socorro, NM

Impact of Soil Water Content on Landmine Detection Using Radar and Thermal Infrared Sensors

Hong, Sung-ho; Miller, Tim; Tobin, Harold; Borchers, Brian; Hendrickx, Jan M.; Jan. 2001; 8 pp.; In English

Report No.(s): AD-A413437; ARO-38830-EL-LMD; No Copyright; Avail: CASI; [A02](#), Hardcopy

Land mines are a major problem in many areas of the world. In spite of the fact that many different types of land mines sensors have been developed, the detection of non-metallic land mines remains very difficult. Most land mine detection sensors are affected by soil properties such as water content, temperature, electrical conductivity and dielectric constant. The most important of these is water content since it directly influences the three other properties in this study, the ground penetrating radar and thermal infrared sensors were used to identify non-metallic land mines in different soil and water content conditions.

DTIC

Ground Penetrating Radar; Infrared Detectors; Mine Detectors; Soil Science; Temperature Sensors

20030067463

Final Report for Grant of Properties of Magnetic Multilayer and Microstructures

Camley, R. E.; Mills, D. L.; Jul. 26, 2002; 9 pp.; In English

Contract(s)/Grant(s): DAAG55-98-0294

Report No.(s): AD-A414264; ARO-375277-PH; No Copyright; Avail: CASI; [A02](#), Hardcopy

This report describes research done on the basic physics of magnetic multilayers and microstructures. Among the problems studied were: 1) Exchange Bias and Coercive Fields in Ferromagnet/Antiferromagnet Structures we examined how these parameters depended on temperature and on surface roughness. 2) Microwave Response of Microstructures Filters and Phase Shifters. Here we looked at exchange-spring systems, microstrip and coplanar notch filters and phase shifters using metallic ferromagnets. 3) Damping Mechanisms in Ferromagnets we developed a two-magnon scattering theory for damping which pays special attention to surface roughness. 4) Static and Dynamic Behavior of Dot Arrays -we showed that the hysteresis curves could be substantially modified by the lattice structure of a magnetic dot array.

DTIC

Magnetic Fields; Magnetic Properties; Microstructure; Ferromagnetic Materials; Antiferromagnetism

20030067490 Massachusetts Inst. of Tech., Cambridge, MA

Quantum Computation With Mesoscopic Superconducting Devices

Orlando, T. P.; Mooij, J. E.; Lloyd, Seth; May 15, 2002; 16 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0369

Report No.(s): AD-A414413; ARO-38809.11-PH-QC; No Copyright; Avail: CASI; [A03](#), Hardcopy

The goal of this research was to explore the use of superconducting circuits as components for quantum computing. Quantum computers are devices that store information on quantum variables and process that information by making those variables interact in a way that preserves quantum coherence. Typically, these variables consist of two quantum states, and the quantum device is called a quantum bit or qubit. Superconducting quantum circuits have been proposed as qubits, in which circulating currents of opposite polarity characterize the two quantum states. Recent experiments show that these two macroscopic quantum states can be put into a superposition. In particular, microwave spectroscopy experiments indicate symmetric and anti-symmetric quantum superpositions of macroscopic states.

DTIC

Circuits; Superconducting Devices; Quantum Computation; Quantum Computers

20030067505

Influence of LCF Loadings on HCF Crack Growth

Byrne, James; Feb. 2003; 27 pp.; In English

Contract(s)/Grant(s): F61775-02-W-E007

Report No.(s): AD-A414479; EOARD-SPC-02-4007; No Copyright; Avail: CASI; [A03](#), Hardcopy

This report results from a contract tasking University of Portsmouth as follows: The contractor will conduct an experimental program to examine the effects of low cycle fatigue (LCF) loading on high cycle fatigue (HCF) crack growth. The project will also extend and refine the current model of combined LCF/HCF fatigue crack growth. The project will use Ti-6Al-4V alloy and corner notched specimens for the combined LCF/HCF testing. The program will focus on three main aspects of the problem: (1) Investigate the effect of LCF overloads on larger number of blocks of HCF cycles than previously used, e.g. 10,000/block versus 1,000/block. (2) Introduce overloads into simple spectrum loading. (3) Extend previous modeling of combined cycle fatigue crack growth based on the results of this project.

DTIC

Crack Propagation; Titanium Alloys; Vanadium Alloys; Aluminum Alloys

20030067626 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

Electron-Cloud Simulation Results for the PSR and SNS

Pivi, M.; Furman, M. A.; 2002; 8 pp.; In English

Report No.(s): DE2003-807415; LBNL-51038; No Copyright; Avail: Department of Energy Information Bridge

We present recent simulation results for the main features of the electron cloud in the storage ring of the Spallation Neutron Source (SNS) at Oak Ridge, and updated results for the Proton Storage Ring (PSR) at Los Alamos. In particular, a complete refined model for the secondary emission process including the so called true secondary, rediffused and backscattered electrons has been included in the simulation code.

NTIS

Computerized Simulation; Electron Clouds; Neutron Sources; Spallation; Storage Rings (Particle Accelerators)

71

ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution*. For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion and Power*.

20030066448 Technische Univ., Delft, Netherlands

Acoustic Field Excited by a Supersonic Source in a Two Media Configuration

Kooij, C.; Kooij, B. J.; Mar. 1999; 14 pp.; In English

Report No.(s): PB2003-104783; ET/EM-1999-04; Copyright; Avail: National Technical Information Service (NTIS)

The acoustic wave field due to a supersonic motion of a rigid object over a half-space is investigated. The research presented here is of great importance for the modeling of the transmitted and reflected conical waves that are excited by airplanes that fly over sea or land. The media involved are acoustically modeled as homogeneous, isotropic fluids and the

moving object is represented an acoustic source of the dipole type. The linearized acoustic field equations are applied to obtain representations for the fields in a combined Laplace-Fourier transform domain. To these representations, which are mapped into the proper form, the authors apply the Cagniard-de Hoop technique in order to find closed form time-domain solutions for the reflected and transmitted acoustic fields. Special wave phenomena, like head waves and reflected and transmitted conical waves, come forward from the procedure as partial result with precursive fronts and clearly defined trailing edges. Numerical results for the reflected as well as the transmitted conical wave are presented.

NTIS

Supersonic Speed; Acoustics; Conical Flow

20030067263 California Inst. of Tech., Pasadena, CA

Stress Wave Propagation Through Heterogeneous Media

May 22, 2002; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAG55-98-1-0237

Report No.(s): AD-A413687; GALTIT-GR-ARO-02-01; ARO-P-38081-EG; No Copyright; Avail: CASI; [A03](#), Hardcopy

In heterogeneous media, scattering due to interfaces/microstructure between dissimilar materials could play an important role in shock wave dissipation and dispersion. In this work the influence of interface scattering on finite-amplitude shock waves was experimentally investigated by impacting flyer plates onto periodically layered polycarbonate/6061 aluminum, polycarbonate/304 stainless steel and polycarbonate/glass composites. Experimental results (obtained using velocity interferometer and stress gage) show that periodically layered composites investigated can support steady structured shock waves. Due to interface scattering, the effective shock viscosity increases with the increase of interface impedance mismatch, and decreases with the increase of interface density (interface area per unit volume) and loading amplitude. The strain rate within the shock front for the composites studied increasing by about the square of the shock stress, comparing with the increasing by the fourth power of the shock stress for homogeneous metals, indicates that layered composites have much larger shock viscosity due to the interface/microstructure scattering. Experimental results also show that due to the scattering effects, shock propagation in the layered composites is dramatically slowing down and the shock speed in composites can be lower than that of either its components.

DTIC

Stress Waves; Strain Rate; Wave Propagation; Heterogeneity; Shock Waves

20030067377 Naval Postgraduate School, Monterey, CA

Examination of the Use of Exact Versus Approximate Phase Weights on the Performance of a Synthetic Aperture Sonar System

Boland, Matthew R.; Mar. 2003; 83 pp.; In English; Original contains color illustrations

Report No.(s): AD-A414590; No Copyright; Avail: CASI; [A05](#), Hardcopy

Synthetic aperture sonar beam forming and signal processing relies on properly steering and focusing the aperture beam pattern in order to co-phase all the received signals. Due to the effects of motion in the synthetic aperture sonar problem, the propagation path between the transmitter, discrete point scatterer, and the receiver is time varying. Traditionally, simple approximations are used to determine these propagation ranges and angles of incidence and scatter. Methods to determine these ranges and angles exactly may significantly improve array gain and, therefore, target detection. This thesis investigates improvements to SAS signal processing algorithms using exact methods for the calculation of the time-varying ranges between transmitter and discrete point scatter, and between discrete point scatter and receiver, and the phase angle of the scattered acoustic signal incident upon the receiver. Using computer simulations, exact range and angle calculations were performed for different scenarios and compared to ranges and angles determined using standard approximations. The exact ranges were then used to determine incident phase, and were again compared to the approximate methods. Comparison of the exact and approximate methods was based on range estimation error and percentage error. Improvements in synthetic aperture array gain using exact phase weights based on exact, time-varying range solutions are proposed.

DTIC

Synthetic Apertures; Sonar; Signal Transmission

20030067453

Analysis of Bearing Errors from Acoustic Arrays

Hurd, Harry L.; Apr. 25, 2002; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAH04-96-C-0027; DAAD19-00-C-0124

Report No.(s): AD-A414246; TR01-1; ARO-40303.3-MA; No Copyright; Avail: CASI; [A03](#), Hardcopy

This report presents a limited analysis of bearing estimates based on acoustic sensors. Significant biases are found in the bearing estimates of all the acoustic sensor arrays involved in the experiment. The explanation of the biases in terms of other factors, such as wind, range and SNR, was beyond the scope of this study. However, the biases do explain much of the track bias observed in recent tracker evaluations.

DTIC

Acoustic Measurement; Errors; Sensors; Arrays

20030067507

The Effects of Background Noise on the Performance of an Automatic Speech Recogniser

Littlefield, Jason; Hashemi-Sakhtsari, Ahmad; Nov. 2002; 37 pp.; In English

Report No.(s): AD-A414420; DSTO-RR-0248; DODA-AR-012-500; X5-X5; No Copyright; Avail: CASI; [A03](#), Hardcopy

Ambient or environmental noise is a major factor that affects the performance of an automatic speech recogniser. Large vocabulary, speaker-dependent, continuous speech recognisers are commercially available. Speech recognisers perform well in a quiet environment, but poorly in a noisy environment. Speaker-dependent speech recognisers require training prior to them being tested, where the level of background noise in both phases affects the performance of the recogniser. This study aims to determine whether the best performance of a speech recogniser occurs when the levels of background noise during the training and test phases are the same, and how the performance is affected when the levels of background noise during the training and test phases are different. The relationship between the performance of the speech recogniser and upgrading the computer speed and amount of memory as well as software version was also investigated.

DTIC

Speech Recognition; Background Noise

72

ATOMIC AND MOLECULAR PHYSICS

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see [73 Nuclear Physics](#).

20030067229 Michigan Univ., Ann Arbor, MI

Development and Application of Semiconductor Quantum Dots to Quantum Computing

Steel, Duncan G.; Mar. 11, 2002; 16 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0373

Report No.(s): AD-A413562; ARO-38821-PH-QC; No Copyright; Avail: CASI; [A03](#), Hardcopy

This work focuses on developing and applying the necessary methodology for the understanding and application of semiconductor quantum dots for quantum computing. Several major milestones were achieved during the present program including the demonstration of optically induced and detected quantum entanglement of two qubits, Rabi oscillation (one bit rotation) in single q-bit, and demonstration of the two-bit system. Future work is focusing on demonstrating a scalable system as well as working to developing lived coherent states based on optically driven spin systems.

DTIC

Quantum Computation; Quantum Dots; Nonlinear Optics

20030067237 Colorado Univ., Boulder, CO

Ultrafast Laser Studies of Molecular Rydberg Wave Packets

Leone, Stephen R.; Jun. 24, 2002; 4 pp.; In English

Contract(s)/Grant(s): DAAD19-00-1-0563

Report No.(s): AD-A413573; FPR-1; ARO-41342.1-PH; No Copyright; Avail: CASI; [A01](#), Hardcopy

Wave packet preparation and probing is investigated in molecules, with particular emphasis on the formation of Rydberg wave packets. A new apparatus has been developed to investigate Rydberg state excitation with ultrafast lasers. It consists of an ultrafast laser system, a cw dye laser for launch state preparation, and an electron time of flight spectrometer. Three photon plus one photon two-color photoionization of Kr has been achieved, with apparent resulting Rydberg wave packet signals. A wave packet has been prepared between the F and G electronic states of lithium dimers, which introduces the electronic degree

of freedom into rovibrational wave packets in a simple diatomic molecule. This is directed towards quantum information manipulations.

DTIC

Wave Packets; Electron Spectroscopy; Photoionization; Time Of Flight Spectrometers; Excitation

20030067261 Scripps Institution of Oceanography, La Jolla, CA

Investigation into the Optical Properties of Nanostructured Silica from Diatoms

Hildebrand, Mark; Palenik, Brian; Feb. 27, 2003; 8 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0165

Report No.(s): AD-A413662; 95-6006144W; AFRL-SR-AR-TR-03-0092; No Copyright; Avail: CASI; [A02](#), Hardcopy

The overall objective of this project was to investigate the optical properties of silica isolated from the unicellular algae known as diatoms. The diatom species used in this study were *Cylindrotheca fusiformis*, *Cyclotella meneghiana*, *Navicula pelliculosa*, and *Nitzschia alba*. Specific objectives were as follows: (1) grow the four different diatom species and prepare purified cell wall silica from them; (2) examine this material through scanning electron microscopy (EM) to determine overall cell dimensions and the dimensions of fine pores in the cell wall; (3) determine absorbance and fluorescence characteristics of the purified silica; (4) test a variety of dyes for their ability to stain diatom silica in vivo, and determine whether the dye treatment could survive the harsh acid treatment used for silica purification; and (5) determine whether material from any species had photonic band gap properties. Results show that two species had regularly repeating pore structures that could potentially generate photonic band gap phenomenon. Absorbance increased with decreasing wavelength, and fluorescence from native diatom silica was low. Out of 6 previously untested dyes, two, rhodamine B and rhodamine 6G, stained diatom silica. Rhodamine 123 was previously shown to stain diatom silica, and the authors showed that fluorescence of this dye survived the harsh acid treatment required to isolate the silica in pure form. Attempts to measure photonic band gap phenomenon from the silica were unsuccessful due to a high degree of scattering in the sample. (1 table, 4 figures, 8 refs.)

DTIC

Fluorescence; Cells (Biology); Silicon Dioxide

20030067293 Massachusetts Inst. of Tech., Cambridge, MA

New Developments in Atom Interferometry

Pritchard, David; May 13, 2002; 9 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0429

Report No.(s): AD-A414540; ARO-P-38931.4-PH; No Copyright; Avail: CASI; [A02](#), Hardcopy

We have pioneered new measurement techniques using coherent atom optics (such as beam-splitters, mirrors and lenses) to manipulate matter waves. During this grant period we built an improved atom interferometer which splits deBroglie waves of matter into two physically separate paths and then recombines the waves to make interference hinges of matter. Using this apparatus our experiments are extremely sensitive to any forces on the atoms.

DTIC

Atoms; Interferometry; Coherent Scattering

20030067342 Air Force Inst. of Tech., Wright-Patterson AFB, OH

Characterizing Motor Vehicle Fleet Emissions by Open-Path Spectroscopy

Branan, Daniel M.; Aug. 2002; 331 pp.; In English

Report No.(s): AD-A414441; CI02-966; No Copyright; Avail: CASI; [A15](#), Hardcopy

In this thesis, I present the conceptual combination of the tunnel study with remote sensing. In other words, I present a technique for measuring fleet-averaged modal emissions from a large aggregate population of vehicles (as in a tunnel study), which employs relatively simple and rugged spectroscopic techniques (as in remote sensing). In combining these two ideas, even more flexibility in measurement location and traffic conditions is achieved, ensuring as random and representative a sampling of the vehicle population as is possible. In that sense, this approach could be referred to as 'A Tunnel-less Tunnel Study,' since it combines the inherent fleet-averaging ability of the tunnel study with the mobility of remote sensing. Specifically, this method combines both OP-FTIR and OP-UV spectroscopy and uses some local meteorological data collection to filter the data for appropriate weather conditions.

DTIC

Air Pollution; Spectroscopy; Remote Sensors; Automobiles

20030067393 Nevada Univ Las Vegas Dept. Of Electrical And Computer Engineering, Las Vegas, NV, USA

Molecular Beam Epitaxy of Nitrides: Theoretical Modeling and Process Simulation

Venkat, Rama; May 22, 2003; 74 pp.; In English

Contract(s)/Grant(s): F49620-99-1-0188

Report No.(s): AD-A414519; No Copyright; Avail: CASI; [A04](#), Hardcopy

A rate equation approach is proposed based on physically sound surface processes to investigate the molecular beam epitaxy growth and doping of III-N using ammonia and EC plasma source. A surface-riding layer of Ga/In/Mg and ammonia or N plasma species with several associated physical and chemical processes is included in this model. In the case of ammonia, the simulated Ga incorporation rate as a function of ammonia pressure and substrate temperature are in excellent agreement with the experimental data. In the case of InGaN growth, results of In incorporation obtained from simulations and experiments are in excellent agreement for various growth conditions. In segregation is found to be negligible below 580 deg C and heavy above 640 deg C. For the given flux rates, it is found that Mg segregates to the surface with the zone is formed below the surface layer.

DTIC

Mathematical Models; Molecular Beam Epitaxy

20030067435 Yale Univ., New Haven, CT

Measurement of the Excited-State Lifetime and Coherence Time of a Microelectronic Circuit

Schoelkopf, R. J.; Lehnert, K. W.; Bladh, K.; Spietz, L. F.; Schuster, D. I.; Aug. 2002; 6 pp.; In English

Contract(s)/Grant(s): DAAD19-99-1-0346

Report No.(s): AD-A414293; ARO-40320.2-PH-QC; No Copyright; Avail: CASI; [A02](#), Hardcopy

We demonstrate that a microelectronic circuit, the Cooper-pair box, is a coherent, quantum two level system whose parameters can be extracted through resonant spectroscopy. The width of the resonant features implies a worst case decoherence rate of the box which is still 150 times slower than the transition rate of two level system, even though it is inhomogenously broadened. Much slower than this decoherence rate is the rate of spontaneous decay of the excited state, which we measure by resolving in time the decay of the box into its ground state with a single electron transistor. We find a spontaneous decay rate which is 10 to the 5th power times slower than the transition rate of the two-level system, even when the measurement is active. This long lifetime and the sensitivity of our measurement will permit a single-shot determination of the box's state.

DTIC

Circuits; Excitation; Microelectronics; Spectroscopy; Measuring Instruments; Coherence

20030067456

Quantum Information Processing

DiVincenzo, David P.; Bennett, Charles H.; Dec. 2, 2001; 6 pp.; In English

Contract(s)/Grant(s): DAAG55-98-C-0041

Report No.(s): AD-A414217; 4; No Copyright; Avail: CASI; [A02](#), Hardcopy

We have made progress on many fronts on the understanding and characterization of entanglement. Various new forms of bound (i.e. undistillable) entanglement have been introduced, as part of our work on unextendable product states. Cases of 'superactivation' of bound entanglement, in which two different bound entangled states, when joined, produce distillable entanglement, have been established for fourparty states and have been conjectured for bipartite states. These results show that the distillable entanglement is neither additive nor convex -- this achieves one of the major three year goals of this project. An explicit formula for the entanglement of formation was found for all isotropic mixed states. We discovered and characterized 'remote state preparation', a generalization of quantum entanglement in which the transmitted quantum state is known to Alice. Very recently, with A. Winter, a new, more efficient protocol for RSP has been discovered. We have continued to study many ideas for the simplification of the Kane approach to quantum computing, with the replacement of electron spin for nuclear spin. Important simplifications over the currently published device designs will be possible. We have worked out a scheme for the implementation of quantum computing, building on the theory of decoherence-free subspaces, that uses only the Heisenberg exchange interaction, or only the XY interaction. We have provided detailed calculations of how g-factor engineering could be realized in III-V semiconductor heterostructures. We have shown how to ameliorate the effects of spin orbit interaction in quantum-dot qubits. We have begun master-equation modeling of superconducting qubits.

DTIC

Quantum Electrodynamics; Semiconductors (Materials); Superconductivity

20030067469 California Univ., Berkeley, CA

Manipulating Optically Dark States for Quantum Logic

Whaley, K. B.; Oct. 29, 2002; 3 pp.; In English

Contract(s)/Grant(s): DAAD19-00-1-0380

Report No.(s): AD-A414350; ARO-41224-PH-QC; No Copyright; Avail: CASI; [A01](#), Hardcopy

We have investigated the use of optically dark states for quantum information processing. We have developed a systematic theoretical approach relating atomic dark states to decoherence-free subspaces and have shown that single qubit manipulations on such dark states are possible to realize with realistic pulse times. We have found a multi-atom dark state in N-atom/cavity systems that can be used to develop an adiabatic ramping scheme to produce N-photon states on demand.

DTIC

Quantum Theory; Atomic Energy Levels

20030067474

Quantum Computing in Solid State, and Coherent Behavior of Open Quantum Systems

Privman, Vladimir; Jan. 2003; 49 pp.; In English

Contract(s)/Grant(s): DAAD19-99-1-0342

Report No.(s): AD-A414285; ARO-40316-PH-QC; No Copyright; Avail: CASI; [A03](#), Hardcopy

We have developed and investigated models of realization of quantum computing in solid-state semiconductor heterostructures, and explored decoherence properties of relevance in evaluation of quantum-computing systems. Quantum bits (qubits) are nuclear or outer bound electron spins in donor atoms embedded in the zero-spin host material, which could be an isotope of Si. In order to accomplish control of each qubit and also have controlled qubit-qubit interactions, we consider exchange of electrons, either bound or in two-dimensional electron gas. Our emphasis has been on spin-excitons that form in the electron gas in heterostructures under quantum Hall effect conditions: at low temperatures and in high magnetic fields. Their spectral gap causes slow relaxation and decoherence, while still allowing controlled qubit-qubit interactions at qubit separations of order 100 nm. We have carried detailed many-body perturbative calculations of qubit interactions and decoherence in such systems. We have also obtained results promoting general understanding of quantum decoherence and measurement processes, within the setting appropriate for quantum computing applications.

DTIC

Quantum Computation; Solid State; Semiconductors (Materials); Quantum Theory

20030067508

Lithographically Patterned Quantum Dot Structures for Infrared Detection

Chou, Stephen; Tsui, Daniel; May 23, 2003; 5 pp.; In English

Contract(s)/Grant(s): DAAD19-99-1-0219

Report No.(s): AD-A414416; ARO-40108.1-EL; No Copyright; Avail: CASI; [A01](#), Hardcopy

Significant progress was made to further advance the quantum well infrared photodetector (QWIP) technology in two areas: 1) designing, demonstrating, and understanding voltage tunable two-color QWIPs, and 2) understanding the light coupling mechanism in the so-called quantum grid infrared photo-detectors. We have also been working on imprint technology to create pillars which can be used to enhance the performance of the photo detectors. The NIL molds with different period and different shape of the pillars have been created. Implementation of the small pillars to photo detectors are in progress.

DTIC

Infrared Detectors; Photometers; Lithography; Quantum Dots; Quantum Theory

20030067527 State Univ. of New York, Stony Brook, NY, USA

Dark States and deBroglie Wave Optics

Metcalf, Harold; May 2003; 8 pp.; In English

Contract(s)/Grant(s): DAAD19-00-1-0499

Report No.(s): AD-A414356; ARO-41369.2-PH; No Copyright; Avail: CASI; [A02](#), Hardcopy

This paper presents the results of experiments conducted at the Research Foundation of SUNY, Stony Brook, NY, by Ph.D. and Master's degree students, undergraduates, visiting high school students, and senior visitors on the manipulation of metastable Helium atoms with polychromatic optical forces, and the study of their properties in dark states, entangled states, and other superpositions. These experiments led to the publication of several Doctoral Theses and other papers. Results are summarized for experiments conducted in the following areas: (1) velocity selective resonances and dark states, (2) stimulated

optical Compton scattering (SOCS), (3) beam slowing of Helium with the bichromatic force, (4) optical forces in frequency-modulated light, and (5) demonstration of adiabatic rapid passage.

DTIC

Helium; Metastable State; Atomic Beams; Quantum Optics; Dark Matter; Optical Properties; Wave Drag

73

NUCLEAR PHYSICS

Includes nuclear particles; and reactor theory. For space radiation see *93 Space Radiation*. For atomic and molecular physics see *72 Atomic and Molecular Physics*. For elementary particle physics see *77 Physics of Elementary Particles and Fields*. For nuclear astrophysics see *90 Astrophysics*.

20030066369 NASA Marshall Space Flight Center, Huntsville, AL, USA

RF Manipulation and Detection of Protons in the High Performance Antiproton Trap (HiPAT)

Martin, James J.; Lewis, Raymond A.; Pearson, J. Boise; Sims, W. Herb; Chakrabarti, Suman; Fant, Wallace E.; McDonald, Stan; [2003]; 1 pp.; In English; Workshop on Non-Neutral Plasmas 2003, 7-11 Jul. 2003, Santa Fe, NM, USA; No Copyright; Avail: CASI; [A01](#), Hardcopy

The significant energy density of matter-antimatter annihilation is attractive to the designers of future space propulsion systems, with the potential to offer a highly compact source of power. Many propulsion concepts exist that could take advantage of matter-antimatter reactions, and current antiproton production rates are sufficient to support basic proof-of-principle evaluation of technology associated with antimatter-derived propulsion. One enabling technology for such experiments is portable storage of low energy antiprotons, allowing antiprotons to be trapped, stored, and transported for use at an experimental facility.

Author

Matter-Antimatter Propulsion; Propulsion System Configurations; Antiprotons; Radio Frequencies; Annihilation Reactions

20030067151 Mission Research Corp., Santa Barbara, CA

The Passage of Energetic Particles Through Matter

Carron, N. J.; Mar. 31, 2003; 26 pp.; In English

Contract(s)/Grant(s): F49620-01-C-0035

Report No.(s): AD-A413718; AFRL-SR-AR-TR-03-0125; No Copyright; Avail: CASI; [A03](#), Hardcopy

This introductory chapter is contained in a book whose purpose was to collect, summarize, document, and put in useful form the basic cross sections, stopping powers, and other parameters characterizing the passage of energetic particles through matter. These energetic particles include photons, electrons, protons, alpha particles, neutrons, and heavy ions. The book is intended to be a working reference providing ready access to useful data, with enough discussion of the background physics to make understandable the order of magnitude of their numerical values. It is not intended to be a comprehensive treatise on the passage of particles through matter. However, references that together may be taken to constitute such a treatise are provided in this chapter. The chapter provides background information on the applications of the cross sections and stopping powers of particles in matter followed by definitions and basic information on the following topics: the difference between a charged particle passing through matter and a neutral particle; electromagnetic fields; radiation and radioactive materials; flux; flux density; fluence; distribution functions and fluxes of particles, including the Boltzmann distribution function and the Maxwellian distribution function; flux and three-dimensional geometry; directed planar flux; bi-directional planar flux and current; planar flux for an isotropic gas; planar flux for a plane beam of particles; omni-directional flux; omni-directional flux for an isotropic gas; omni-directional flux for a plane beam; and energy spectrum and spectral fluence.

DTIC

Charged Particles; Neutrons; Electrons; Photons; Protons

20030067334 Michigan Univ., Ann Arbor, MI

Recoil-Induced-Resonances in Nonlinear, Ground-State, Pump-Probe Spectroscopy

Search, C. P.; Berman, P. R.; Mar. 11, 2001; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A414457; No Copyright; Avail: CASI; [A03](#), Hardcopy

A theory of pump-probe spectroscopy is developed in which optical fields drive two-photon Raman transitions between

ground states of an ensemble of three-level atoms. Effects related to the recoil the atoms undergo as a result of their interactions with the fields are fully accounted for in this theory.

DTIC

Recoil Atoms; Spectroscopy; Nonlinearity

20030067623 Department of Energy, Richland, WA, USA

Strategic Planning for Hot Cell Closure

Langstaff, D. C.; Feb. 2001; 19 pp.; In English

Report No.(s): DE2003-805993; DOE-0288-FP; No Copyright; Avail: Department of Energy Information Bridge

The USA Department of Energy (DOE) and its contractor were remediating a large hot cell complex to mitigate the radiological hazard. A Resource Conservation and Recovery Act (RCRA) closure unit was determined to be located within the complex. The regulator established a challenge to develop an acceptable closure plan on a short schedule (four months). The scope of the plan was to remove all excess equipment and mixed waste from the closure unit, establish the requirements of the legally binding Closure Plan and develop an acceptable schedule. The complex has several highly radioactive tanks, tank vaults, piping, and large hot cells containing complex chemical processing equipment. Driven by a strong need to develop an effective strategy to meet cleanup commitments, three principles were followed to develop an acceptable plan: (1) Use a team approach, (2) Establish a buffer zone to support closure, and (3) Use good practice when planning the work sequence. The team was composed of DOE, contractor, and Washington State Department of Ecology (Regulator) staff. The team approach utilized member expertise and fostered member involvement and communication. The buffer zone established an area between the unregulated parts of the building and the areas that were allegedly not in compliance with environmental standards. Introduction of the buffer zone provided simplicity, clarity, and flexibility into the process. Using good practice means using the DOE Integrated Safety Management Core Functions for planning and implementing work safely. Paying adequate attention to detail when the situation required contributed to the process credibility and a successful plan.

NTIS

Ecology; Management Planning; Radiology; Radiation Hazards

20030067649 Johns Hopkins Univ., Baltimore, MD

Demonstration of Surface Modification and Cell Interactions of Asymmetric Magnetic Nanowires

Reich, Daniel H.; Sep. 2002; 9 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0384; Proj-L400

Report No.(s): AD-A414838; AFRL-SR-AR-TR-03-0211; No Copyright; Avail: CASI; [A02](#), Hardcopy

The ability to selectively manipulate and probe molecules at the cellular and sub-cellular level is critical both in basic research and in the development of biotechnology applications. One powerful method to do this is to use small particles that interact with individual cells or specific molecules, and which respond to an electric or magnetic field. This approach has found widespread application in cell sorting, biosensing, and studies of mechanical properties of cells using magnetic particles. However, a significant limitation of these magnetic carriers is that they have only a single chemical functionality per particle. In this research program, we are beginning development of a new type of magnetic carrier: multifunctional magnetic nanowires. These nanowires will be able to carry out multiple tasks e.g. binding multiple types of molecules, probing chemical activity in specific regions of a cell, and responding to light as well as to magnetic fields. This was a one-year 'Seedling Project' whose goal was to carry out key initial experiments to demonstrate the feasibility of creating and employing multifunctional magnetic nanowires for biotechnology and defense-relevant applications. The results obtained have provided a knowledge base from which to start development of a wide range of uses of the nanowires. This work is currently ongoing under DARPA/AFOSR support. The specific research objectives of this project included: (i) Functionalization of single- and multi-component nanowires, (ii) Demonstration of binding interactions between nanowires and cells, and (iii) Magnetic manipulation of cells and nanowires. We have made significant progress in all three areas.

DTIC

Biotechnology; Nanotechnology

74 OPTICS

Includes light phenomena and the theory of optical devices; for specific optical devices see also *35 Instrumentation and Photography*.
For lasers see *36 Lasers and Masers*.

20030066261

Detection of Biological Warfare Pathogens by Rare Event Imaging

Chen, Lan Bo; May 17, 2003; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD-19-01-1-0321

Report No.(s): AD-A414196; ARO-42301.1-LS; No Copyright; Avail: CASI; [A03](#), Hardcopy

The standard methods for the detection and identification of pathogens require that either a sufficient amount of such pathogens are present or that these pathogens are grown under selective conditions. These procedures are time consuming and inadequate in many situations. The objective of this project was to establish a rapid and extremely sensitive method to detect and identify BW pathogens in our environment and in human body fluids using the revolutionary approach of Rare Event Imaging. During the grant period different immunofluorescence and fluorescence in situ hybridization based protocols were developed for the sensitive and specific detection of pathogens. The Rare Event Imaging System (REIS) was adopted to be able to detect the fluorescently labeled rare cells fast and reliably. Simultaneous enumeration of multiple pathogens was achieved with the REIS. The utility of the fully automated REIS approach in clinical diagnostics was shown with using the Cytomegalovirus antigenemia assay.

DTIC

Fluorescence; Assaying; Pathogens; Biological Weapons

20030066961 Naval Research Lab., Bay Saint Louis, MS

Seasonal Variations in Optical Conditions Associated with the Mobile Bay Outflow Plume

Johnson, Donald R.; Weidemann, Alan D.; Arnone, Robert A.; Goode, Wesley; Gould, Richard; Nov. 22, 2002; 9 pp.; In English

Report No.(s): AD-A413729; NRL/PP/7330/02/0063; No Copyright; Avail: CASI; [A02](#), Hardcopy

River and estuarine outflow waters contain high loads of colored dissolved organic material (CDOM or gelbstoff), sediments, and biological matter with strong optical signatures. In regions with large, single point sources, interactions with ambient shelf waters are fairly simple. The buoyant outflow plumes tend to remain cohesive and become trapped against the contra sole coast. These plumes can extend for distances of more than 100 km along coast with characteristic widths of 5-15 km (internal Rossby radius of deformation) and thickness of a few 10's of meters. When winds turn to upwelling favorable, the plume waters are rapidly dispersed, mixing their optically important constituents across the shelf. Wind relaxation or a turn to downwelling favorable wind initiates a new along-coast plume. Such strong dynamic/optical interactions drive high variability in coastal optical character. The objective of this study is to examine this high dynamic variability in relationship to seasonal variations in forcing and constituent loading fields.

DTIC

Optical Properties; Plumes; Annual Variations; Dissolved Organic Matter

20030066963 Naval Research Lab., Bay Saint Louis, MS

The Biogeo-Optical Model: The Database & Testing

Stavn, Robert H.; Gould, Richard W.; Lamela, Gia; Nov. 22, 2002; 8 pp.; In English

Report No.(s): AD-A413732; NRL/PP/7330/02/0067; No Copyright; Avail: CASI; [A02](#), Hardcopy

Parameterization of optical Case 2 waters, especially near-shore waters, continues to challenge our modeling and predictive capabilities because of the significant effect of suspended mineral matter on the optical properties of these waters. It has been pointed out that there is a paucity of optical information for the suspended mineral matter of coastal waters^{2,3}. Supplying this gap our knowledge will create a new field, geo-optics, which is absolutely necessary for construction of adequate coastal optical model and will even be of importance for Case 1 waters when the open ocean receives mineral matter from dust storms and gets a significant admixture of iron for plankton blooms. The majority of activity in the study of ocean optical properties has been the creation of chlorophyll-based models⁴, the quantification of absorption cross sections, and the partitioning of the absorption coefficient into its various organic components. In this report we are making a contribution to the new field of geo-optics by investigating the optical scattering cross section of suspended mineral matter in Mobile Bay,

Alabama. Combining these data with bio-optically based optical data on suspended organic matter gives us the biogeo-optical model of coastal ocean optical properties.

DTIC

Optical Properties; Data Bases; Parameterization; Coasts; Optical Data Processing

20030066966 Naval Research Lab., Bay Saint Louis, MS

Partitioning Optical Properties Into Organic and Inorganic Components from Ocean Color Imagery

Gould, Richard W.; Stavn, Robert H.; Twardowski, M. S.; Lamela, Gia; Nov. 22, 2002; 12 pp.; In English

Report No.(s): AD-A413734; NRL/PP/7330/02/0065; No Copyright; Avail: CASI; [A03](#), Hardcopy

Current ocean color satellite algorithms generally partition the total absorption coefficient into two components, one due to phytoplankton and one due to the combined effect of detritus and colored dissolved organic matter (CDOM, or gelbstoff). Detritus and CDOM exhibit similar spectral shapes so they are typically modeled together. The separation of the particulate phase into organic and inorganic components through remote sensing has only recently been addressed. We present algorithms to estimate the concentrations of total suspended solids (TSS), particulate organic matter (POM), and particulate inorganic matter (PIM) from SeaWiFS imagery. Furthermore, we partition the combined CDOM/detrital absorption coefficient into separate components, and using a previously published algorithm, we partition the scattering coefficient (b) into organic (b_o) and inorganic (b_i) components.

DTIC

Optical Properties; Organic Materials; Nonflammable Materials

20030067177 Arizona Univ., Tucson, AZ

Nanotechnology Instrumentation

Gibbs, Hyatt M.; Khitrova, Galina; Feb. 2003; 9 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0419

Report No.(s): AD-A413738; AFRL-SR-AR-TR-03-0119; No Copyright; Avail: CASI; [A02](#), Hardcopy

Various instruments have been purchased and tested that extend existing nanotechnology capabilities and complement existing equipment. The fact that these laboratories have worked for several years on 3D microcavities and micron-size spectroscopic measurements clarified the need for several complementary instruments. The major new thrust made possible by this grant is spectroscopic capability at 1300 nm. A CCD camera system provides very sensitive detection from 800 to 1600 nm. The existing fs Ti:Sa laser was modified to optimize it for pumping a new optical parametric oscillator, providing short pulses from 1100 to 1600 nm, and the new Millennium X solid state pump provides improved beam stability and efficiency. These instruments have enabled the study of quantum dots and 3D nanocavities, both photonic-crystals and microdisks, in the 1000 -1300 nm range. A cryostat with nanopositioners within the vacuum has greatly facilitated these measurements, requiring micron stability for minutes. Its temperature control enables scanning of the dot-nanocavity detuning and temperature-dependent measurements.

DTIC

Photoluminescence; Nanotechnology; Quantum Dots; Optical Equipment

20030067231 New Mexico State Univ., Las Cruces, NM

Light Control of Fractal Nanoparticles

Armstrong, Robert L.; Mar. 14, 2002; 6 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0425

Report No.(s): AD-A413632; NMSU-01-4-21625; ARO-37287.3-PH-H; No Copyright; Avail: CASI; [A02](#), Hardcopy

This final report details the findings of the cited ARO Grant. During the Grant, a number of experiments were performed illustrating the unique characteristics of fractal and fractal/microcavity media, in particular, their capability to support nonlinear optical effects under conditions of extremely weak incident light. These findings are supported by a number of research papers and conference presentations discussed in the report.

DTIC

Fractals; Nanoparticles; Nonlinear Optics; Electromagnetic Radiation

20030067240 Optical Society Of America Washington DC, Washington, DC, USA

Nonlinear Guided Waves and their Applications. Technical Digest

Sep. 4, 2002; 552 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0065

Report No.(s): AD-A413586; AFRL-SR-AR-TR-03-0146; No Copyright; Avail: CASI; [A24](#), Hardcopy

The OSA topical meetings that received support under this grant provided a forum for researchers in various specialty areas to meet and share ideas and technology in their fields. This Technical Digest contains the meeting agenda and technical papers from the Nonlinear Guided Waves and Their Applications Meeting. This report emphasizes techniques in the areas of materials, fabrication, devices, applications and non linear theory.

DTIC

Nonlinear Optics; Optical Waveguides; Fabrication; Nonlinearity

20030067348 Rand Corp., Santa Monica, CA

Improving Dispute Resolution for California's Injured Workers. Executive Summary

Pace, Nicholas M.; Reville, Robert T.; Galway, Lionel; Geller, Amanda B.; Hayden, Orla; Jan. 2003; 31 pp.; In English
Report No.(s): AD-A414418; RAND/MR-1425; No Copyright; Avail: CASI; [A03](#), Hardcopy

California's 90-year-old workers' compensation system is designed to provide injured workers immediate and speedy relief without re-sorting to a formal trial. Instead of involving judges and the civil courts, injured workers may simply file a claim through a no-fault, administrative process. In theory, the process for delivering workers' compensation benefits, such as medical care, replacement of lost wages, and vocational rehabilitation services, is precisely defined in the California Labor Code and other regulations and is mostly automatic. In reality, however, disputes often arise over issues such as whether an injury in fact occurred at work, whether medical treatment is necessary, and the extent to which an injury poses long-term consequences for the worker. All such disputes are resolved in a single forum: the Workers' Compensation Appeals Board (WCAB). Of the one million workers' compensation claims filed in California every year, about 200,000 end up at the WCAB.

DTIC

Resolution; Medical Services; Injuries; Regulations

20030067357 Lawrence Livermore National Lab., Livermore, CA

Lith 112 High-NA Optics for the Micro-Exposure Tool (MET)

Taylor, J. S.; Gabella, P.; Hudyma, R.; Sommargren, G.; Phillion, D.; Oct. 01, 2002; In English
Report No.(s): DE2003-15003272; No Copyright; Avail: National Technical Information Service (NTIS)

Project Lith 112 High-NA Optics was initiated in 43-1999 to lay the groundwork for constructing a small-field imaging system for use in a high-NA micro-exposure tool (MET) to support the development of EUVL resists and for assessing defect printability. A paradigm had been established at ISMT for resist development for 193-nm and 157-nm lithography, which involved employing micro-exposure tools several years prior to production to serve as platforms for developing resists. Key goals for the MET are to demonstrate the extensibility of EUVL to the 35-nm lithographic node, and to support resist development over multiple EUV generations. Since the fabrication of the optics was viewed as a long-lead activity, proceeding with fabricating the optics was a means of meeting the long-term need for an E W MET, prior to committing to an exposure platform.

NTIS

Lithography; Imaging Techniques

20030067392 NASA Marshall Space Flight Center, Huntsville, AL, USA

Genetic Algorithm Phase Retrieval for the Systematic Image-Based Optical Alignment Testbed

Taylor, Jaime; Rakoczy, John; Steincamp, James; January 09, 2003; 6 pp.; In English; Genetic and Evolutionary Conference, 12-16 Jul. 2003, Chicago, IL, USA; Original contains black and white illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy

Phase retrieval requires calculation of the real-valued phase of the pupil function from the image intensity distribution and characteristics of an optical system. Genetic algorithms were used to solve two one-dimensional phase retrieval problems. A GA successfully estimated the coefficients of a polynomial expansion of the phase when the number of coefficients was correctly specified. A GA also successfully estimated the multiple phases of a segmented optical system analogous to the seven-mirror Systematic Image-Based Optical Alignment (SIBOA) testbed located at NASA's Marshall Space Flight Center. The SIBOA testbed was developed to investigate phase retrieval techniques. Tip/tilt and piston motions of the mirrors accomplish phase corrections. A constant phase over each mirror can be achieved by an independent tip/tilt correction: the phase conjugation term can then be factored out of the Discrete Fourier Transform (DFT), greatly reducing computations.

Author

Genetic Algorithms; Mirrors; Optical Equipment

20030067434 Michigan Univ., Ann Arbor, MI

Atomic Interference in Standing Wave Fields

Berman, Paul R.; Sleator, Tycho; Mar. 13, 2001; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAG55-97-1-0113

Report No.(s): AD-A414290; No Copyright; Avail: CASI; A03, Hardcopy

The long-term goal of this project is to create nanostructures by passing a beam of atoms through two or more standing wave light fields. Following interaction with the standing wave fields, the atomic density contains all even spatial harmonics of the standing wave light field. At appropriate distances following the interaction with the light fields the different harmonics are focused, enabling one to isolate each of the harmonics. By transferring the atomic density spatial distribution to a surface, one can create pure harmonic gratings having periods as small as tens of nanometers. In addition to forming pure harmonic gratings, we are working on methods to effectively focus atoms with high resolution (spot size of order 15 nm) and high periodicity (of order 50 nm). Methods for probing the density patterns with nanometer resolution are being explored.

DTIC

Standing Waves; Atoms; Wave Excitation; Electromagnetic Interference; Nanostructures (Devices)

75

PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 *Geophysics*. For space plasmas see 90 *Astrophysics*.

20030066285 Lawrence Livermore National Lab., Livermore, CA, USA

LDRD Final Report Adaptive Methods for Laser Plasma Simulation

Dorr, M. R.; Garaizar, F. X.; Hittinger, J. A. F.; Jan. 29, 2003; 12 pp.; In English

Report No.(s): DE2003-15003251; UCRL-ID-151774; No Copyright; Avail: Department of Energy Information Bridge

The goal of this project was to investigate the utility of parallel adaptive mesh refinement (AMR) in the simulation of laser plasma interaction (LPI). The scope of work included the development of new numerical methods and parallel implementation strategies. The primary deliverables were (1) parallel adaptive algorithms to solve a system of equations combining plasma fluid and light propagation models, (2) a research code implementing these algorithms, and (3) an analysis of the performance of parallel AMR on LPI problems. The project accomplished these objectives. New algorithms were developed for the solution of a system of equations describing LPI. These algorithms were implemented in a new research code named ALPS (Adaptive Laser Plasma Simulator) that was used to test the effectiveness of the AMR algorithms on the Laboratory's large-scale computer platforms. The details of the algorithm and the results of the numerical tests were documented in an article published in the *Journal of Computational Physics*.

NTIS

Laser Plasma Interactions; Algorithms; Parallel Programming

20030066287 Princeton Univ., NJ

Kinetic-Fluid Model

Cheng, C. Z.; Johnson, J. R.; 2002; 34 pp.; In English

Report No.(s): DE2003-16722; No Copyright; Avail: Department of Energy Information Bridge

A nonlinear kinetic-fluid model for high plasmas with multiple ion species which can be applied to multiscale phenomena is presented. The model neglects due to finite ion Larmor radius (FLR), wave-particle resonances, magnetic particle trapping, etc. in the framework of simple fluid descriptions. When further restricting to low frequency phenomena with frequencies less than the ion cyclotron frequency the kinetic-fluid model takes a simpler form in which the fluid equations of multiple ion species collapse into single-fluid density and momentum equations are introduced via plasma pressure tensors for ions and electrons which are computed from particle distribution functions that are governed by the Vlasov equation or simplified plasma dynamics equations such as the gyrokinetic equation.

NTIS

Fluid Mechanics; Plasma Pressure

20030066333 Computer Sciences Corp., USA, NASA Ames Research Center, Moffett Field, CA, USA

Collective Excitations in InAs Well Intersubband Transitions

Li, Jian-Zhong; Ning, Cun-Zheng; [2003]; 4 pp.; In English

Contract(s)/Grant(s): DTT59-99-D-00437; NASA Order A-61812-D; No Copyright; Avail: CASI; [A01](#), Hardcopy

Intersubband transitions in semiconductor quantum well are studied using a density matrix theory that goes beyond the Hartree-Fock approximation by including the full second order electron-electron scattering terms in the polarization equation for the first time. Even though the spectral features remain qualitatively similar to the results obtained with dephasing rate approximation, significant quantitative changes result from such a more detailed treatment of dephasing. More specifically, we show how the interplay of the two fundamental collective excitations, the Fermi-edge singularity and the intersubband plasmon, leads to significant changes in lineshape as the electron density varies.

Author

Quantum Wells; Semiconductors (Materials); Electron Density (Concentration); Excitation; Matrix Theory

20030067213 Princeton Univ., NJ

Microwave Imaging Reflectometer for TEXTOR

Munsat, T.; Mazzucato, E.; Park, H.; Deng, B. H.; Domier, C. W.; Jul. 2002; 16 pp.; In English

Report No.(s): DE2003-807252; PPPL-3721; No Copyright; Avail: Department of Energy Information Bridge

Understanding the behavior of fluctuations in magnetically confined plasmas is essential to the advancement of turbulence-based transport physics. Though microwave reflectometry has proven to be an extremely useful and sensitive tool for measuring small density fluctuations in some circumstances, this technique has been shown to have limited viability for large amplitude, high kq fluctuations and/or core measurements. To this end, a new instrument based on 2-D imaging reflectometry has been developed to measure density fluctuations over an extended plasma region in the TEXTOR tokamak. This technique is made possible by collecting an extended spectrum of reflected waves with large-aperture imaging optics. Details of the imaging reflectometry concept, as well as technical details of the TEXTOR instrument will be presented. Data from roof-of-principle experiments on TEXTOR using a prototype system is presented, as well as results from a systematic off-line study of the advantages and limitations of the imaging reflectometer.

NTIS

Imaging Techniques; Microwave Imagery; Microwave Reflectometers; Two Dimensional Models

20030067414 Technical Research Centre of Finland, Espoo, Finland

Symposium on Fusion Technology (22nd), Book of Abstracts

Tahtinen, S.; Tintamaa, R.; Asikainen, M.; Tuomisto, H.; 2002; In English, September 9 - 13, 2002, Helsinki, Finland

Report No.(s): PB2003-105981; VTT/SYMPOSIUM-220; No Copyright; Avail: National Technical Information Service (NTIS)

The objective of the Symposium on Fusion Technology (SOFT) is to exchange information on design, construction and operation of fusion experiments and the technology of present fusion machines, the next step and power plant devices. It includes oral and poster presentations as well as an industrial and research and development exhibition.

NTIS

Fusion Reactors; Plasma Diagnostics; Conferences; Abstracts

76

SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also *33 Electronics and Electrical Engineering*; and *36 Lasers and Masers*.

20030067215 National Renewable Energy Lab., Golden, CO, Colorado School of Mines, Golden, CO, USA, North Carolina Univ., Chapel Hill, NC, USA, California State Univ., Los Angeles, CA, USA

Narrow Gap a-SiGe:H Grown by Hot-Wire Chemical Vapor Deposition

Nelson, B. P.; Xu, Y.; Williamson, D. L.; Han, D.; Braunstein, R.; Aug. 2002; 26 pp.; In English

Report No.(s): DE2003-15003227; NREL/CP-520-33142; No Copyright; Avail: Department of Energy Information Bridge

We have improved the quality of our narrow bandgap a-SiGe:H grown by hot-wire chemical vapor deposition (HWCVD) by decreasing our W filament diameter and our substrate temperature. We now grow a-SiGe:H with Tauc bandgaps below 1.5 eV having a photoresponse equal to or better than our plasma enhanced CVD grown alloys. We enhanced the transport

properties as measured by the photoconductivity frequency mixing technique relative to previous HWCVD results. These improved alloys do not necessarily show an improvement in the degree of structural heterogeneity on the nanometer scale as measured by small-angle x-ray scattering. Decreasing both the filament temperature and substrate temperature produced a film with relatively low structural heterogeneity while photoluminescence showed an order of magnitude increase in defect density for a similar change in the process.

NTIS

Vapor Deposition; Crystal Growth; Germanium Alloys; Silicon Alloys; Photoluminescence

20030067343 California Univ., Los Angeles, CA

Low Power Multifunctionality Optoelectronic Devices for Mobile Digital Battlefield

Wang, Kang L.; Mar. 30, 2002; 13 pp.; In English

Contract(s)/Grant(s): DAAG55-98-1-0358

Report No.(s): AD-A414237; ARO-34998-EL; No Copyright; Avail: CASI; [A03](#), Hardcopy

We have grown high quality Ge quantum dots on Si selective epitaxial growth (SEG) facets as well as tilted Si substrates. We have also controlled the formation of the SEG mesas to achieve one-dimensional ridges on stripe Si patterns in attempt to form an ordered dot array. At 8K the photoluminescence spectrum shows the contribution from Ge wetting layers and Ge quantum dots. Studies on the control of Ge dot positioning have been conducted. Several different configurations of the positioning have also been observed with the variation of the Ge thickness deposited. The intersubband absorption in self-assembled boron-doped and modulation-doped multiple Ge quantum dots was studied. An absorption peak in the midinfrared range is observed at room temperature by Fourier transform infrared spectroscopy which is attributed to the transitions between the first two heavy-hole states of the Ge quantum dots. Si-based photodetectors operating at 1.3-1.55 microns for the purpose of fiber communications were studied. I-V measurement shows a low dark current density of 3×10^{-5} A/cm at 1 V. A strong response at 1.3-1.5 was observed. Highest efficiency of 8% was observed at a bias of -2.5 V.

DTIC

Germanium; Quantum Dots; Optoelectronic Devices

20030067355 Lawrence Livermore National Lab., Livermore, CA

New Idea for a Solid-State Microrefrigerator Operating Near 100mK

Ullom, J. N.; van der Berg, M. L.; Labov, S. E.; Sep. 18, 2000; 10 pp.; In English

Report No.(s): DE2003-15003265; UCRL-JC-137836; No Copyright; Avail: Department of Energy Information Bridge

No abstract available

NTIS

Solid State; Refrigerators; Temperature Dependence; Semiconductor Junctions

20030067424 North Carolina Univ., Charlotte, NC, USA

A New Approach for Combined Epitaxial Metallization and Heavy Doping of Shallow Junctions

Hasan, M. A.; Jan. 2000; 21 pp.; In English

Contract(s)/Grant(s): Proj-2000-0175

Report No.(s): AD-A414440; ARO-41103-MS; No Copyright; Avail: CASI; [A03](#), Hardcopy

This short-term innovative research project investigated the epitaxial growth of silicon deposited from the vapor phase onto an Al-covered silicon substrate. The 60 nm Al layer behaved as if it were transparent to the Si flux. The silicon cleanly passed through the Al layer to the buried Al/Si interface where it formed a defect-free Si layer on the original single crystal Si substrate. The new growth method is referred to as solid-metal mediated molecular beam epitaxy (SMM-MBE). Most of the work focused on Si(111), but some initial results were also obtained for Si(100).

DTIC

Metallizing; Molecular Beam Epitaxy; Doping (Materials)

20030067439 Fermi National Accelerator Lab., Batavia, IL, USA

Two Decades of Mexican Particle Physics at Fermilab

Rubinstein, R.; 2003; 7 pp.; In English

Report No.(s): DE2003-805267; No Copyright; Avail: Department of Energy Information Bridge

This report is a view from Fermilab of Mexican particle physics at the Laboratory since about 1980; it is not intended to be a history of Mexican particle physics: that topic is outside the expertise of the writer. The period 1980 to the present

coincides with the growth of Mexican experimental particle physics from essentially no activity to its current state where Mexican groups take part in experiments at several of the world's major laboratories.

NTIS

Particle Production; Nuclear Physics

20030067460

Control-Oriented Modeling and Feedback Compensation For a Thin-Film TiNi Actuator

M'Closkey, Robert T.; Carman, Greg P.; Jun. 15, 2002; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-99-1-0138

Report No.(s): AD-A414252; No Copyright; Avail: CASI; [A02](#), Hardcopy

This study sought to derive thermal and hysteresis models of actuation systems employing thin film NiTi. Future actuators are likely to exploit the high energy densities available from NiTi; however, an impediment to its application in high-bandwidth actuators has been the slow thermal time constants associated with the bulk material. High-bandwidth actuators using thin film NiTi show great promise due to the increased rates of heat transfer. This grant supported the design, fabrication, and characterization of a NiTi bubble actuator and the fabrication, testing, and excitation of a silicon beam's first resonant mode with a NiTi thin film. This grant also supported the development of the authors' thin film processing techniques. (6 figures)

DTIC

Thermodynamic Properties; Thin Films; Actuators; Hysteresis; Shape Memory Alloys; Boundary Layers; Vibration Damping

20030067488 Pennsylvania State Univ., University Park, PA

Molecular Photonics of Supra Nonlinear Liquid Crystals

Khoo, Iam-Choon; May 11, 2003; 12 pp.; In English

Contract(s)/Grant(s): DAAD19-00-1-0128

Report No.(s): AD-A414372; ARO-P-41093.1-PH; No Copyright; Avail: CASI; [A03](#), Hardcopy

This program is focused on understanding recent discoveries of the optical nonlinearities of the metaphases of liquid crystals, and novel nonlinear optical phenomena enabled by the extremely large nonlinearities in these material systems. Both collective and individual molecular optical properties have been investigated experimentally. Quantitative theories of the basic physics as well as novel phenomena and the working principles of multifunctional optical devices have also been developed. Specifically: (1) The large optical nonlinearities of nematic liquid crystals in the optical communication wavelength regime (1.55 microns) as well as the visible region have been quantitatively established. (2) All-optical self-action processes such as stimulated scattering and polarization switching, and self-starting optical phase conjugation using thin (microns) nematic films with very low power cw infrared lasers have been demonstrated, along with the development of quantitative theories. (3) Novel optical elements/devices such as liquid-crystal photonic crystals, nonlinear optical fibers and fiber arrays were developed using nematic as well as isotropic phase liquid crystals. (4) Quantitative theoretical descriptions of their tunable and nonlinear transmission/ reflection properties, and optical limiting actions and practical devices; feasibility demonstration of the nonlinear fiber array limiting devices. (5) Demonstration of the feasibility of optical soliton formation in nematic liquid crystals. (vi) Synthesis of a new class of extremely nonlinear liquid with superior optical limiting performance, wide temperature stability and very fast (picosecond - nanosecond) nonlinear electronic absorption properties suitable for limiting applications against agile frequency lasers.

DTIC

Nonlinear Optics; Liquid Crystals; Photonics; Molecular Structure

20030067502

Quantum Mechanical Calculations of Monoxides of Silicon Carbide Molecules

Roberts, John W., Jr; Mar. 2003; 228 pp.; In English; Original contains color illustrations

Report No.(s): AD-A414378; AFIT/GNE/ENP/03-09; No Copyright; Avail: CASI; [A11](#), Hardcopy

Modern semiconductor devices are principally made using the element silicon. In recent years, silicon carbide (SiC), with its wide band-gap, high thermal conductivity, and radiation resistance, has shown prospects as a semiconductor material for use in high temperature and radiation environments such as jet engines and satellites. A limiting factor in the performance of many SiC semiconductor components is the presence of lattice defects formed at oxide dielectric junctions during processing. Recent theoretical work has used small quantum mechanical systems embedded in larger molecular mechanics structures to attempt to better understand SiC surfaces and bulk materials and their oxidation. This research uses quantum mechanical

models to calculate geometries and electronic properties of small Si(m)C(n)O molecular clusters of silicon carbide oxides with 0 less than or equal to m, n less than or equal to 4. Calculations are primarily done using Hartree-Fock and Density Functional Theory (DFT) with the B3LYP exchange and correlation functionals. Moller-Plesset Second Order Perturbation (MP2), Configuration Interaction (CI), Multi-Configurational Self-Consistent Field (MCSCF), and Coupled Cluster (CC) are used on the CSi2Q molecule to confirm the accuracy of selected levels of DFT. Molecular properties examined include ground state multiplicity, vibrational modes and frequencies, and geometry for both the neutral and anion, adiabatic and vertical electron affinities, and thermodynamic heats of formation. Qualitative predictions are made regarding the photoelectron spectrum experimentalists may see. Finally, preferred geometries, functional groups, and bonding locations are qualitatively determined. Later research will be able to use these results to study the oxidation of larger SiC structures and surfaces and their defects.

DTIC

Clusters; Silicon Carbides; Quantum Statistics; Quantum Mechanics

20030067599 Computer Sciences Corp., USA, NASA Ames Research Center, Moffett Field, CA, USA

Microscopic Modeling of Intersubband Resonances in InAs/AlSb Quantum Wells

Li, Jian-Zhong; Kolokolov, K. I.; Ning, Cun-Zheng; Larrabee, D. C.; Khodaparast, G. A.; Kono, J.; Ueda, K.; Nakajima, Y.; Sasa, S.; Inoue, M.; [2003]; 4 pp.; In English; 11th International Conference on Narrow Gap Semiconductors, 16-20 Jun. 2003, Buffalo, NY, USA

Contract(s)/Grant(s): DTTS59-99-D-00437; NASA Order A-61812-D; Copyright; Avail: CASI; A01, Hardcopy

Linear absorption spectra from intersubband resonance in InAs/AlSb quantum wells are analyzed theoretically using the intersubband semiconductor Bloch equation approach. Our model goes beyond the Hartree-Fock approximation and treats particle-particle correlations under the second Born approximation. Electron-electron and -LO phonon scatterings from such a treatment describe intrinsic line broadening to the intersubband resonance. Electron subbands are determined self-consistently with a spurious-state-free 8-band k.p Hamiltonian under the envelope function approximation. To compare with experimental measurements, we also included line broadening due to electron-interface roughness scattering. Excellent agreement was achieved for temperature-dependent absorption spectra in the mid-infrared frequency range, after taking into careful account the interplay of material parameters, nonparabolicity in bandstructure, and many-body effects.

Author

Mathematical Models; Indium Arsenides; Aluminum Antimonides; Quantum Wells; Resonance; Semiconductors (Materials)

20030067622 Princeton Univ., NJ

X-ray Shadowgraph Camera Design

Doman, M. J.; McCrea, E. J.; Rohde, R. A.; 2002; 12 pp.; In English

Report No.(s): DE2003-2698; No Copyright; Avail: Department of Energy Information Bridge

An imaging camera that is used with X-ray radiography systems in high explosive experiments has been built and fielded. The camera uses a 40mm diameter Micro-Channel Plate Intensifier (MCPI) for optical gain and photographic film for image recording. In the normal location of the X-ray film pack, a scintillating screen is placed instead. The camera system views the screen and records the image. The sensitivity of the MCPI to light makes the camera design sensitive to small details that a film pack does not need to consider. The X-ray image recording system was designed and built for situations where the film pack of the X-ray shadowgraph is not retrievable after the experiment. The system has been used in a number of experiments.

NTIS

X Rays; Imaging Techniques; Cameras

20030067627 Poitiers Univ., France, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

Macro Stress Mapping on Thin Film Buckling

Goudeau, P.; Villain, P.; Renault, P. O.; Tamura, N.; Celestre, R. S.; 2002; 10 pp.; In English

Report No.(s): DE2003-807428; No Copyright; Avail: Department of Energy Information Bridge

Thin films deposited by Physical Vapor Deposition techniques on substrates generally exhibit large residual stresses which may be responsible of thin film buckling in the case of compressive stresses. Since the 80's, a lot of theoretical work has been done to develop mechanical models but only a few experimental work has been done on this subject to support these theoretical approaches and nothing concerning local stress measurement mainly because of the small dimension of the buckling (few 10th micrometers). This paper deals with the application of micro beam X-ray diffraction available on

synchrotron radiation sources for stress mapping analysis of gold thin film buckling.

NTIS

Thin Films; Buckling; Mapping; Residual Stress; Delaminating

77

PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also *72 Atomic and Molecular Physics*, *73 Nuclear Physics*, and *25 Inorganic, Organic and Physical Chemistry*.

20030066249 Rutherford Appleton Lab., Chilton

Particle Physics Experiments Report 2001

Moley, J.; Feb. 2002; 392 pp.; In English

Report No.(s): PB2003-105146; RAL-TR-2002-004; Copyright; Avail: National Technical Information Service (NTIS)

This report describes work carried out in 2002 on experiments approved by the Particle Physics Experiments Selection Panel. The contents consist of unedited contributions from each experiment.

NTIS

Elementary Particles; Experimentation

20030067251 Naval Postgraduate School, Monterey, CA

Computer Aided Thermal Analysis of a Technology Demonstration Satellite (NPSAT1)

Gruhlke, Martin; May 5, 2003; 169 pp.; In English

Report No.(s): AD-A413589; NPS-SP-03-001; No Copyright; Avail: CASI; [A08](#), Hardcopy

The thermal control system of a spacecraft is used to maintain all subsystems within their temperature limits. It must be able to deal with different operational states and orbital environments. Theory provides knowledge about the quality of effects of certain designs options but for a complex system like a spacecraft simulations are needed for qualification. This thesis has two main purposes. Critical parts concerning thermal control in the current design are identified and the thermal design for NPSAT1 is improved. Furthermore this developed design is analyzed for being appropriate and temperature-time predictions are developed. Both design objectives are accomplished with the help of EDS 1-DEAS with Maya's TMG. After defining all constraints and requirements a thermal FE model is developed documented and verified. Simulations with this model are used to track insufficiencies concerning the thermal design. With their help, different design approaches are analyzed to obtain sensitivity information. Proposals for design changes are made Four worst-case scenarios are defined and the developed design is evaluated with their help.

DTIC

Thermal Analysis; Artificial Satellites; Temperature Control; Computer Aided Design; Satellite Temperature

20030067430 Sierra Engineering Inc Carson City NV, Carson City, NV, USA

5Klbf Unielement TCA for Film Cooling Model Validation

Muss, Jeffrey; Apr. 24, 2003; 38 pp.; In English

Contract(s)/Grant(s): F04611-00-C-0009; Proj-3005

Report No.(s): AD-A414443; AFRL-PR-ED-VG-2003-090; No Copyright; Avail: CASI; [A03](#), Hardcopy

This document is a report of the 5Klbf Unielement TCA for Film Cooling Model Validation.

DTIC

Film Cooling; Liquid Propellant Rocket Engines; Models; Proving

80

SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula. For specific topics in these areas see *categories 81 through 85*.

20030066780 NASA Ames Research Center, Moffett Field, CA, USA

From Montana to Mars: Using the Journals of Lewis and Clark to Teach Exploration Science for Mars

Scott, D. M.; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The most important strategy for the future exploration of Mars is to prepare students and educators for that exploration. 2003 is a teachable year. In 2003 NASA will send two new robotic rover explorers to Mars. 2003 also marks the Bicentennial of the Lewis and Clark expedition. By examining the Lewis and Clark expedition as an analogue, in the context of modern-day exploration to other worlds, students can learn about their home planet as well as about issues central to all exploration. During the past five years, in cooperation with the University of Montana, a Guide for teaching exploration science using the Expedition and Journals of Lewis and Clark as an analogue for Mars, we have prepared an Educator's Guide. Although designed with K-12 students in mind, it was also designed to be adaptable to all levels of education. In this session, the newly-published Guide will be presented and described. One or two activities may also be demonstrated.

Author

Education; Mars Exploration

81

ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20030066256 General Accounting Office, Washington, DC

Business Modernization: Improvements Needed in Management of NASA's Integrated Financial Management Program

Apr. 2003; 82 pp.; In English

Report No.(s): PB2003-105901; GAO-03-507; No Copyright; Avail: CASI; [A05](#), Hardcopy

The National Aeronautics and Space Administration's (NASA) nonintegrated financial management systems have weakened its ability to oversee its contractors, and its contract management has been on GAO's high-risk list since 1990. In April 2000, NASA began its Integrated Financial Management Program (IFMP), its third attempt in recent years at modernizing financial management processes and systems. GAO was asked to review whether NASA was following key best practices in acquiring IFMP components and implementing one of the first components-the core financial module.

NTIS

Contract Management; NASA Programs; Financial Management; Congressional Reports

20030066388 Korea Civil Aviation Development Association, Korea, Republic of

A Study on the Air Transport Cooperation in Northeast Asia between China, Japan and Korea

Sun, Kim Kyu; The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 2; July 2001; 32 pp.; In English; See also 20030066377; Copyright; Avail: CASI; [A03](#), Hardcopy

For a considerable period of time, the air transport has been regarded as a special economic activity with its own regulatory system, particularly in that all states relate air space to their sovereignty and national security. And bilateral regulatory system based upon reciprocity has been dominant in international air transport industry. As almost all sorts of economic activity have a strong tendency to transcend national borders these days, the economic globalization has now become a firmly rooted phenomenon throughout the world. Free trade and fair competition is a prevalent concept in so far as economic activity is concerned. Responding to these global economic trends, the international air transport has been and will be deregulated and liberalized further. Particularly, bilateral and sub-regional liberalization of air transport market has been remarkable. Also, the multilateral liberalization of air transport services through WTO GATS frame has been discussed. The most likely scenario of deregulation and liberalization at present is an expanding patchwork of phase-in liberalization in the field of air transport industry, both through bilateral agreements and through regional multilateral agreements. In the context of those rapid changes in the global marketplace, there has been an increasing awareness to develop stronger aviation links in Northeast Asia between China, Japan and Korea. With regards to realizing the concept and the approaches to it, several challenges are expected due to different viewpoints among countries of the region. However, the air transport industries in the Northeast Asia should not isolate itself from the global trends. There needs a paradigm shift from the traditional concept in the region. This paper identifies the needs of sub-regional air transport liberalization in Northeast Asia between China, Japan and Korea, and reviews the strategies and practical measures for air transport liberalization in the region.

Author

Agreements; Air Transportation; Competition; Economics; Industries; Security

20030066389 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne, Germany

Cooperation Among German Airports in Europe

Meincke, Peter A.; The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 2; July 2001; 9 pp.; In English; See also 20030066377; Copyright; Avail: CASI; [A02](#), Hardcopy

Contents include the following: 1. The Market environment of airports in Europe. 2. Effects of the market environment on the airports - Competition of airports. 3. Cooperation and ownership stakes among airports. 3.1 'Open' or 'free-and-easy' Cooperation: Cooperation in the Secondary Market and Competition on Primary Market. 3.2 Ownership Cooperation among Airports or partnership shares in other Airports. 3.3 Cooperation through holding structure and/or within airport systems. 3.3.1 Examples for holding company structure in Germany. 3.3.2 Example for holding company structure: AIRPORT GERMANY LIMITED COMPANY. 3.4 Cooperation in airport networks and/or enterprise compound. 3.5 PANTARES ALLIANZ - Cooperation between the airports Frankfurt and Amsterdam. 4. Possible advantages of a airport cooperations. 5. Subject of 'shift of air traffic'. 5.1 The legal factors are not given. 5.2 Airlines must be convinced with different ways of acting by the airport management.

CASI

Germany; Europe; Airline Operations; Competition

20030066551 Arizona Univ., Tucson, AZ, USA

The Phoenix Scout Mission

Smith, P. H.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Scout missions to Mars were proposed in response to a NASA Announcement of Opportunity (AO); 20 full mission proposals were received in August 2002. All missions were required to launch in 2007 and meet a cost cap of \$325M that encompasses all mission costs including the launch vehicle and a healthy reserve. The cost cap proved to be a tight constraint forcing many proposers to descope their original concepts. Step 1 proposals were judged in a rigorous series of reviews primarily on the basis of their science goals and implementation; however, no missions that were deemed high risk by the technical review panel were selected. In December 2002, four missions were selected to proceed into Step 2, a 6-month Phase A study to advance the technical design, management plan, and cost to a level of detail that ensures that the mission can meet all its science goals within the cost cap. Phoenix was one of the four missions selected. A final decision in August 2003 will authorize a single mission to proceed.

Derived from text

Mars Missions; Design To Cost; Management Planning

20030067672 NASA, Washington, DC, USA

ASK Magazine, No. 13

Post, Todd, Editor; Pellen, Charles; August 2003; 44 pp.; In English; See also 20030067673 - 20030067682; No Copyright; Avail: CASI; [A03](#), Hardcopy

Many of the stories in this magazine for NASA project managers are written by project managers, who use anecdotes from their experience to illustrate managerial lessons. This issue also includes features, an interview, and book reviews.

CASI

NASA Programs; Project Management

20030067673 NASA, Washington, DC, USA

Dropping in on Mars

Rivellini, Tommaso P.; ASK Magazine, No. 13; August 2003, pp. 18-21; In English; See also 20030067672; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

Here I was: 26 years old, I had never worked on a flight project before, and all eyes were on me. Every time I walked by the Pathfinder project office, Tony Spear, the project manager, would throw his arm around me and announce, 'Hey everybody, the whole mission is riding on this guy right here.' Our task was to design and build airbags for Pathfinder's landing on Mars - an approach that had never been used on any mission. Airbags may seem like a simple, low-tech product, but it was eye-opening to discover just how little we knew about them. We knew that the only way to find out what we needed to learn was to build prototypes and test them. We just didn't know how ignorant we were going to be. Airbags seemed like a crazy idea to a lot of people. Nobody ever said that, mind you, but there seemed to be a widespread feeling that the airbags weren't

t going to work. 'We'll let you guys go off and fool around until you fall flat on your faces.' That was the unspoken message I received day after day.

Author

NASA Programs; Project Management

20030067675 NASA, Washington, DC, USA

The Storyboard's Big Picture

Malloy, Cheryl A.; Cooley, William; ASK Magazine, No. 13; August 2003, pp. 24-25; In English; See also 20030067672; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

At Science Applications International Corporation (SAIC), Cape Canaveral Office, we're using a project management tool that facilitates team communication, keeps our project team focused, streamlines work and identifies potential issues. What did it cost us to install the tool? Almost nothing.

Author

Project Management; Organizing

20030067678 NASA Johnson Space Center, Houston, TX, USA

Smart Buying

Gonzalez, Steven A.; ASK Magazine, No. 13; August 2003, pp. 7-9; In English; See also 20030067672; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

When it came time to buy the next-generation data storage system for the Mission Control Center at Johnson Space Center, we asked our contractor who provides Control Center support to come up with a solution that would consolidate three current storage systems, as well as provide additional capability and functionality - all without spending vast amounts of money. Eventually, the contractor's report arrived at my office. To my great disappointment, the proposed system came along with a multi-million dollar price tag. And, even more disappointing, the system relied on the same technology we already had in place and wouldn't deliver much additional functionality. It was clear that we needed to come up with a better solution-the best we could buy. But how do you buy the best technology, when you don't even know what technology is out there?

Author

Government Procurement; NASA Programs; Management

20030067679

Supplying the Giant

Lawson, Larry; ASK Magazine, No. 13; August 2003, pp. 22-23; In English; See also 20030067672; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

It was critical for our team to find a radically different way of doing business. Deciding to build the airframe out of composites was the first step, refining processes from the boat building industry was second, and the final step was choosing a supplier. Lockheed Martin built the first prototypes at our Skunk Works facility in Palmdale, California. These units were hand-built and used early prototypical tooling. They looked great but were not affordable. We had to focus on minimizing touch labor and cycle time and reducing material costs. We needed a company to produce the composite quilts we would use to avoid hand lay-ups. The company we found surprised a lot of people. We partnered with a small company outside of Boston whose primary business was making baseball bats and golf club shafts.

Derived from text

Defense Program; Project Management

20030067680 NASA, Washington, DC, USA

Off the Charts

Muirhead, Brian K.; ASK Magazine, No. 13; August 2003, pp. 17; In English; See also 20030067672; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

NASA basically looked at the two options and said, 'Well, propulsion...that's the old way of doing business. You guys will never get this job done if you do it that way. It's too expensive.' And so we said, 'Okay, let's go make this airbag thing work.' The airbags idea was clearly eccentric. Off the charts. When you think of an airbag, you think of the automobile design, about twice the size of a pillow, which took many years to develop. But what we needed would have to be about 19 feet in diameter, designed to tolerate a head-on collision with a very rocky Mars surface at 60 miles per hour or more. And not just once, but multiple times, as it bounced and rolled to a stop. The only thing in common between our design and an automobile

airbag was the name. Another very eccentric aspect of this was the idea of using fabrics in outer space. We were used to dealing in aluminum and titanium, but is needed to be the stuff of bulletproof vests...advanced polymer cloth. We'd worked with software in space, but not 'softgoods.'

Author

NASA Programs; Project Management

20030067681 Starsys Research Corp., Boulder, CO, USA

A Small as Possible

Tibbitts, Scott; ASK Magazine, No. 13; August 2003, pp. 10-11; In English; See also 20030067672; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

This story begins with a bit of serendipity: I was on a trip to see a Shuttle launch and I happened to sit next to a guy who was in charge of batteries for Space Systems/Loral. He told me that they needed to create a new battery bypass switch, the device that takes a battery out of commission if it goes bad. After discussing the conversation back at my company, we decided that we could create the switch. We contacted the folks at Loral and they said, 'Okay, let s see what you can come up with. We need it as small as possible.' We asked, 'How small?' They said, 'We need it as small as you can possibly make it.'

Author

NASA Programs; Project Management; Miniaturization; Miniature Electronic Equipment

82

DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer program documentation see *61 Computer Programming and Software*.

20030066252 Newcastle-upon-Tyne Univ., Newcastle

Systems, Advisory Systems and Safety

Oliveras, C. S.; Jan. 2003; 24 pp.; In English

Report No.(s): PB2003-105207; CS-TR-774; Copyright; Avail: National Technical Information Service (NTIS)

Increasing the automation level of systems has led to more attention being paid to human control roles and the dependability of systems that comprise operators and machines. When humans build mental models of complex automated systems, they can be faced with problems regarding situation awareness. Moreover, these complex systems may lead to knowledge-based errors in situations where decision-making has to be performed. To cope with such situations, one may wish to consider advisory systems. An advisory system is a type of decision support system that tackles the complexity of systems with regard to human judgement for decision-making. This paper describes an approach to systems, advisory systems and their human use for safe operation. The intention is to initiate a future path for a formal description of systems in which an advisory system might play a role for their dependability.

NTIS

Decision Support Systems; Human Factors Engineering

20030066923

The Information Revolution in the Middle East and North Africa

Burkhart, Grey E.; Older, Susan; Jan. 2003; 85 pp.; In English

Contract(s)/Grant(s): DASW01-01-C-0004

Report No.(s): AD-A413892; No Copyright; Avail: CASI; [A05](#), Hardcopy

RAND is conducting a multiyear effort, sponsored by the National Intelligence Council (NIC), to explore the future of the information revolution throughout the world. This is a multidisciplinary effort with a broad range of participants from both inside and outside of RAND, with an overarching goal of mapping the likely future of the global information revolution over the next one to two decades. This effort has included a series of international conferences on specific aspects of the information revolution, involving experts in various relevant areas. This publication reports the results of one of those studies, on the likely course of the information revolution in the Middle East and North Africa over the next five to 10 years. Key questions addressed in this report include the extent to which the information revolution has taken hold in this region in general, the

variations between individual countries, and prospects for further information technology (IT)-related developments in the region.

DTIC

Information Systems; Intelligence; Information Transfer

20030067239 New Mexico State Univ., Las Cruces, NM, USA

A Proposal to Develop a Biotechnology Information Facility

Spalding, John B.; Clark, Sherri; Lammers, Peter J.; May 31, 2002; 31 pp.; In English

Contract(s)/Grant(s): DAAH04-96-1-0415

Report No.(s): AD-A413470; ARO-35919.1-LS-BIF; No Copyright; Avail: CASI; [A03](#), Hardcopy

The objective of this grant was to develop facilities and information resources that support current research in biotechnology and to meet the goal of strengthening the biological science programs at HBCUs/MIs. As a result, the National Biotechnology Information Facility (NBIF) was established at New Mexico State University (NMSU). NBIF retained that name until September 2001, at which time its name was changed to the Southwest Biotechnology and Informatics Center (SWBIC). SWBIC was given a 6-month, no-cost extension, which changed the end of the period of performance to 9 March, 2002. SWBIC has become a recognized center for the biotechnology information resources presented through its website <http://www.swbic.org/>. The most important accomplishments achieved during the grant are presented in this report, and include substantial work in education and outreach to promote biotechnology careers at HBCUs/MIs. Also, the capital improvements funded by the grant have resulted in a world-class biotechnology and bioinformatics facility in the third floor of the new Biochemistry wing at NMSU. It is the goal of SWBIC to maintain these resources and continue the goal of supporting biotechnology education and research both here and at other HBCUs/MIs.

DTIC

Biotechnology; Information Management; Education

20030067250 Army War Coll., Carlisle Barracks, PA

Information Operations: Reassessing Doctrine and Organization

Mackey, Randall L.; Mar. 17, 2003; 42 pp.; In English

Report No.(s): AD-A413656; No Copyright; Avail: CASI; [A03](#), Hardcopy

Information operations will play a key role in pursuing information superiority as part of the Joint Vision 2020 goal of achieving full spectrum dominance. Despite the importance of information operations within the U.S. vision of future conflict, the U.S. military does not have a consistent and coherent understanding of information operations. Information operations mission areas are ill defined and what should be basic terminology is complex, full of nuances, and inconsistent. Organization within DoD to accomplish 10 missions is also less than optimal. In some cases different unrelated 10 missions are assigned to organizations in an effort to consolidate responsibility for 10. Yet in other instances closely related missions that should be centralized are assigned to different organizations. This paper examines the various mission areas under 10 as currently defined, proposes modifications, and presents a new taxonomy for 10 and 10 component mission areas. This paper also examines current 10 organizations within DoD and makes recommendations for realignment of 10 missions.

DTIC

Information Systems; Electronic Warfare; Organizations; Military Technology

20030067257 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA

Remote Sensing Systems Optimization for Geobase Enhancement

Paylor, Steve J.; Mar. 2003; 188 pp.; In English; Original contains color illustrations

Report No.(s): AD-A413615; AFIT/GEE/ENV/03-20; No Copyright; Avail: CASI; [A09](#), Hardcopy

The U.S. Air Force is in the process of implementing GeoBase, a geographic information system (GIS), throughout its worldwide installations, Air Force GIS needs can be augmented by imagery from aerial and satellite platforms. Imagery has greatly improved over the past several years and provides high resolution coverage of features on earth. Various imagery types will significantly increase GeoBase usefulness in a range of mission requirements, Potential Air Force uses of imagery include identifying heat loss, environmental monitoring, command decision-making, and emergency response, The research develops a decision tool to determine the appropriate imagery for a given Air Force Application, Current literature identified proven imagery applications, Literature review and a 2002 Air Force Geo-Integration Office (AF/GIO) survey were used to develop a comprehensive imagery applications list that satisfies Air Force mission requirements, An imagery decision matrix was crafted that allows a user to select an application and see imagery that fulfills the requirements for the task, An imagery system

key provides further details of each imagery type, The matrix was tested at three Air Force bases, Increased awareness of the possibilities of an imagery-enriched GeoBase, and the efficiency afforded by the matrix, greatly reduces the time to identify and implement imagery, Available imagery was identified for the three Air Force bases at the National Imagery and Mapping Agency (NIMA) through a government contract at no additional cost, Current IKONOS imagery of Elmendorf Air Force base was obtained for analysis and implementation into GeoBase.

DTIC

Data Bases; Aerial Photography; Geographic Information Systems; Satellite Imagery

20030067267 Army Research Lab., Adelphi, MD

Information Assurance Issues and Requirements for Distributed Electronic Records Archives

Nguyen, Binh Q.; Apr. 2003; 36 pp.; In English

Report No.(s): AD-A413692; ARL-TR-2963; No Copyright; Avail: CASI; [A03](#), Hardcopy

This document reports the findings of a 6-month study focused on the initial information assurance (IA) requirements for safeguarding distributed electronic records archives (ERA) in network environments capable of providing speedy communications and swift transfer of electronic records and software tools among National Archives and Records Administration (NARA) administrators and researchers. The report also includes Internet addresses of IA-related organizations that can offer NARA further information about our national strategy for safeguarding cyberspace and technical details about IA strategies and technological products.

DTIC

Electronics; Information Systems; Communication Networks; Records Management

20030067288 Army War Coll., Carlisle Barracks, PA

Machine Translation: A Key to Information Supremacy and Knowledge-Based Operations

Koh, James; Apr. 7, 2003; 40 pp.; In English

Report No.(s): AD-A414522; No Copyright; Avail: CASI; [A03](#), Hardcopy

Informational Globalization unleashed by the recent advent of information technology has brought the world closer than ever by placing the world on a single information grid. Ironically, abundance of data makes information a much more serious and important commodity. This is because access to data is no longer limited to those few well-endowed nations, but others who did not previously have such privilege. This presents a new challenge and opportunity. The value of information is based not solely on its content and accuracy, but also on its speed of acquisition. Acquiring relevant and accurate information from data before others often decides a victor. From this perspective, information globalization is about information competition that turns data into information and knowledge.

DTIC

Knowledge Based Systems; Machine Translation

20030067289 Wisconsin Univ., Madison, WI

Effects of Alternative Decision Support Technologies on Breast Cancer Patients' Knowledge of Options and Satisfaction With Treatment Decisions

Gustafson, David H.; Jan. 2003; 212 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-98-1-8259

Report No.(s): AD-A414531; No Copyright; Avail: CASI; [A10](#), Hardcopy

The objectives of the research were to (1) develop an innovative CDSS that will enable women to integrate the information available to them, understand diagnoses, treatment options, and risks associated with treatment options, construct and structure their preferences, and make important health decisions, and (2) assess the impact of the new CDSS by making it available to women newly diagnosed with breast cancer and comparing it with existing technology (the Internet) and a control group is a carefully designed experiment. The assessment of the impact was made in terms of understanding of diagnoses, treatment options, and risks associated with treatment options, satisfaction with decisions made, amount of involvement in decision, compliance with decision, change in health status and change in quality of life. Specifically, we compared two types of decision support technologies to a control group: 1. CHESS: a new CDSS designed specifically to meet breast cancer patients' needs; 2. Internet: the rapidly proliferating Internet technology; 3. Control: standard patient education along with one of three books on breast cancer or a set of audiotapes produced by the National Coalition for Cancer Survivorship.

DTIC

Decision Support Systems; Health; Education; Diagnosis

20030067309 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA

An Investigation of Air Force Communities of Practice: A Descriptive Study of Evolution Through Assessment of People, Process, and Technology Capabilities

May, Jason R.; Mar. 2003; 130 pp.; In English; Original contains color illustrations

Report No.(s): AD-A414521; AFIT/GIR/ENV/03-11; No Copyright; Avail: CASI; [A07](#), Hardcopy

A variety of theories state that communities of practice (CoPs) 'evolve' or 'mature' through various stages over time. Such theories posit that each stage is characterized by different people, process, and technology attributes/ capabilities that ultimately necessitate differing strategies for achieving effectiveness (Gongla and Rizzuto, 2001). A primary goal of AFMC/DRW, AFMC electronic Learning (eLearning) Knowledge Management Integrated Project Team, and the office of the Air Force Chief Information Officer is to increase CoP participation and effectiveness. This descriptive, cross-sectional research, surveyed all CoP managers of all CoPs 'hosted' by AFMC/DRW with a quantitative/ qualitative, 86 question, 5-point Likert, survey. This research suggested that, on average, AF/AFMC CoPs are in the very early stages of evolution, and the extent of implementation for stage-specific attributes/capabilities was found to be minimal. The implications of this finding show, given the relatively 'undeveloped nature' of many of the CoPs, there are a wide range of actions that can be taken to improve the efficiency and effectiveness of existing CoPs. These actions include increasing leadership involvement and support, increasing membership education and training, defining more clearly the purpose/objectives of each CoP, and implementing easier technology tools for navigating the COP collaborative electronic workspace.

DTIC

Surveys; Education

20030067347 Army Armament Research, Development and Engineering Center, Watervliet, NY

Index to Benet Laboratories Technical Reports - 2002

Shuman, R. D.; Apr. 2003; 34 pp.; In English

Report No.(s): AD-A414435; ARCCB-SP-03007; No Copyright; Avail: CASI; [A03](#), Hardcopy

A principal challenge by the U.S. Army TACOM-ARDEC Benet Laboratories in the design of armaments for lightweight future fighting vehicles with lethality overmatch is mitigating the deleterious effects of large caliber cannon recoil. The sonic RAREfaction wave low recoil guN (RAVEN) is a novel invention to dramatically reduce the gas momentum contribution to recoil with absolutely no reduction in the ballistic efficiency of launch. This technology is being investigated as part of the future combat vehicle armaments program conducted at Picatinny Arsenal, NJ, and Watervliet Arsenal, NY.

DTIC

Lethality; Combat; Tanks (Combat Vehicles)

20030067404 Naval War Coll., Newport, RI

Cyberspace - A New Medium for Operational Warfare

Achterberg, Kevin L.; Feb. 3, 2003; 22 pp.; In English

Report No.(s): AD-A414617; No Copyright; Avail: CASI; [A03](#), Hardcopy

Transformation to the information age will give rise to a new medium for operational warfare cyberspace just as the industrial age ushered in the new mediums of air and sea (in particular, undersea). Cyberspace (and corresponding information warfare and operations) will take its place next to air, land and sea as a fourth medium that the joint operational commander will have to consider in applying Operational Art across all levels of war generally and at the operational level of war specifically.

DTIC

Information Systems; Media; Warfare

20030067485 Air Force Inst. of Tech., Wright-Patterson AFB, OH

Reed Chambers the Rise of an Aviation Entrepreneur

Stafford, Matthew C.; May 29, 2003; 452 pp.; In English

Report No.(s): AD-A414393; AFIT-CI-02-977; No Copyright; Avail: CASI; [A20](#), Hardcopy

The life of Reed McKinley Chambers was investigated, with an emphasis on his development as an entrepreneurial manager. From his boyhood, Chambers demonstrated a predilection for aviation that was first put into practical use when he flew for the military in World War I. After the war, he returned to the USA with the hope of finding a commercial application for aviation. He founded an aerial photography company in California and America's first scheduled airlines in Florida. These endeavors failed, because of a lack of suitable demand for his services, technological limitations and, in the case of his airline,

an absence of insurance to protect aviation investors from natural and operational disasters. His experience prompted Chambers to join David Beebe in founding America's first aviation insurance group, a company that has survived into the present day.

DTIC

Civil Aviation; Aircraft Industry; Military Operations; Biography

84

LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes aviation law; space law and policy; international law; international cooperation; and patent policy.

20030067455 State Dept., Washington, DC, USA

Country Reports on Human Rights Practices, 2000: Mauritius

Feb. 23, 2001; 14 pp.; In English

Report No.(s): PB2003-105568; No Copyright; Avail: CASI; [A03](#), Hardcopy

The Republic of Mauritius, a parliamentary democracy since 1968, is governed by a prime minister, a council of ministers, and a national assembly. The President, who is nominated by the Prime Minister and confirmed by the National Assembly, serves as Head of State, with largely ceremonial powers. A paramilitary Special Mobile Force under civilian control is responsible for internal security. The economy is based on labor-intensive, export-oriented manufacturing (mainly textiles), as well as sugar and tourism. The Government generally respected the human rights of its citizens; however, there were problems in some areas.

NTIS

Mauritius; International Trade; Human Relations

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SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 93*.

20030066267 NASA Marshall Space Flight Center, Huntsville, AL, USA

Physical and Structural Studies on the Cryo-cooling of Insulin Crystals

Lovelace, J.; Bellamy, H.; Snell, E. H.; Borgstahl, G.; [2003]; 1 pp.; In English

Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail: Other Sources; Abstract Only

Reflection profiles were analyzed from microgravity-(mg) and earth-grown insulin crystals to measure mosaicity (h) and to reveal mosaic domain structure and composition. The effects of cryocooling on single and multi-domain crystals were compared. The effects of cryocooling on insulin structure were also re-examined. Microgravity crystals were larger, more homogeneous, and more perfect than earth crystals. Several mg crystals contained primarily a single mosaic domain with havg of 0.005deg. The earth crystals varied in quality and all contained multiple domains with havg of 0.031deg. Cryocooling caused a 43-fold increase in h for mg crystals ($\text{havg}=0.217\text{deg}$) and an %fold increase for earth crystals ($\text{havg}=0.246\text{deg}$). These results indicate that very well-ordered crystals are not completely protected from the stresses associated with cryocooling, especially when structural perturbations occur. However, there were differences in the reflection profiles. For multi-mosaic domain crystals, each domain individually broadened and separated from the other domains upon cryo-cooling. Cryo-cooling did not cause an increase in the number of domains. A crystal composed of a single domain retained this domain structure and the reflection profiles simply broadened. Therefore, an improved signal-to-noise ratio for each reflection was measured from cryo-cooled single domain crystals relative to cryo-cooled multi-domain crystals. This improved signal, along with the increase in crystal size, facilitated the measurement of the weaker high- resolution reflections. The observed broadening of reflection profiles indicates increased variation in unit cell dimensions which may be linked to cryo-cooling-associated structural changes and disorder.

Author

Single Crystals; Insulin; Cryogenic Cooling; Signal To Noise Ratios

20030066288 NASA Marshall Space Flight Center, Huntsville, AL, USA

Hot Views on Cold Crystals: The Application of Thermal Imaging in Cryo-crystallography

Snell, E. H.; vanderWoerd, M. J.; Deacon, A.; [2003]; 1 pp.; In English; American Crystallographic Association Conference, 26-31 Jul. 2003, Covington, KY, USA

Contract(s)/Grant(s): NAS8-02096; Copyright; Avail: Other Sources; Abstract Only

In the past we have used thermal imaging techniques to visualize the cryocooling processes of macromolecular crystals. From these images it was clear that a cold wave progresses through a crystal starting at the face closest to the origin of the cold stream and ending at the point furthest away. During these studies we used large volume crystals, which were clearly distinguished from the loop holding them. These large crystals, originally grown for neutron diffraction studies, were chosen deliberately to enhance the imaging. As an extension to this work, we present used thermal imaging to study small crystals, held in a cryo-loop, in the presence of vitrified mother liquor. The different infrared transmission and reflectance properties of the crystal in comparison to the mother liquor surrounding it are thought to be the parameter that produces the contrast that makes the crystal visible. An application of this technology may be the determination of the exact location of small crystals in a cryo-loop. Data from initial tests in support of application development was recorded for lysozyme crystals and for bFGF/dna complex crystals, which were cryo-cooled and imaged in large loops, both with visible light and with infrared radiation. The crystals were clearly distinguished from the vitrified solution in the infrared spectrum, while in the case of the bFGF/dna complex the illumination had to be carefully manipulated to make the crystal visible in the visible spectrum. These results suggest that the thermal imaging may be more sensitive than visual imaging for automated location of small crystals. However, further work on small crystals robotically mounted at SSRL did not clearly visualize those crystals. The depth of field of the camera proved to be limiting and a different cooling geometry was used, compared to the previous, successful experiments. Analysis to exploit multiple images to improve depth of field and experimental work to understand cooling geometry effects is ongoing. These results will be presented along with advantages and disadvantages of the technique and a discussion of how it might be applied.

Author

Cryogenic Cooling; Crystallography; Crystal Growth; Imaging Techniques; Infrared Radiation

20030066434 NASA Marshall Space Flight Center, Huntsville, AL, USA

Crystal Growth Rate Dispersion: A Predictor of Crystal Quality in Microgravity?

Kephart, Richard D.; Judge, Russell A.; Snell, Edward H.; vanderWoerd, Mark J.; [2003]; 1 pp.; In English; American Crystallographic Association Meeting, 26-31 Jul. 2003, Covington, KY, USA; Copyright; Avail: Other Sources; Abstract Only

In theory macromolecular crystals grow through a process involving at least two transport phenomena of solute to the crystal surface: diffusion and convection. In absence of standard gravitational forces, the ratio of these two phenomena can change and explain why crystal growth in microgravity is different from that on Earth. Experimental evidence clearly shows, however, that crystal growth of various systems is not equally sensitive to reduction in gravitational forces, leading to quality improvement in microgravity for some crystals but not for others. We hypothesize that the differences in final crystal quality are related to crystal growth rate dispersion. If growth rate dispersion exists on Earth, decreases in microgravity, and coincides with crystal quality improvements then this dispersion is a predictor for crystal quality improvement. In order to test this hypothesis, we will measure growth rate dispersion both in microgravity and on Earth and will correlate the data with previously established data on crystal quality differences for the two environments. We present here the first crystal growth rate measurement data for three proteins (lysozyme, xylose isomerase and human recombinant insulin), collected on Earth, using hardware identical to the hardware to be used in microgravity and show how these data correlate with crystal quality improvements established in microgravity.

Author

Crystal Growth; Diffusion; Convection; Microgravity

20030066436 Universities Space Research Association, Huntsville, AL, USA

Perfectly Cold Crystals: What Happens When They Are X-rayed?

vanderWoerd, Mark; Ferree, Darren S.; Snell, Edward H.; [2003]; 1 pp.; In English; American Crystallographic Association (ACA) Meeting, 26-31 Jul. 2003, Covington, KY, USA; Copyright; Avail: Other Sources; Abstract Only

For many macromolecular crystals the cryo-preservation of these crystals during X-ray data collection is of crucial importance, particularly at synchrotron facilities where the crystals rapidly receive a high dose of radiation. A practical variable to ensure adequate preservation is the variation of the cryo-protectant present when the crystal is preserved. Our initial approach to study X-ray diffraction data quality as a function of cryo-protectant present when preserving a xylose isomerase crystal shows that the data quality can be tremendously improved by recipe adjustment. Guided by crystal mosaicity estimates,

we optimized crystal growth conditions to obtain cryo-preserved xylose isomerase crystals that withstand a very high dose of X-rays, with only the smallest amount of radiation damage at ultra-high resolution (1.2 Angstroms). The rate at which damage occurs allowed us to collect a series of complete data sets, which show how the data degradation proceeds over time. We are here presenting data for the xylose isomerase crystallization recipe improvement and our interpretation of the crystal degradation process during X-ray data collection.

Author

Crystal Growth; X Ray Diffraction; X Rays

20030066510 California Inst. of Tech., Pasadena, CA, USA

Photochemical Studies of Chemistry in the Outer Solar System

Yung, Yuk L.; [2003]; 3 pp.; In English

Contract(s)/Grant(s): NAG5-6263; No Copyright; Avail: Other Sources; Abstract Only

The goal of the proposed science investigation is to gain a quantitative understanding of chemical processes and their coupling with atmospheric dynamics in the reducing atmospheres of the outer solar system, with a particular focus on Infrared Space Observatory (ISO) observations and future experiments such as the Cassini Mission to Saturn and Titan. The proposed work is divided into two related tasks. We have carried out a systematic comparison between atmospheric models for every giant planet and Titan, which employ a consistent set of photochemical reactions. Combined with recent observations of hydrocarbon species by ISO, this can provide the most rigorous test of our current understanding of the photochemistry of hydrocarbon in the outer solar system. The emphasis will be on the methyl radical (CH₃), first detected by ISO in the atmospheres of Saturn and Neptune (Bezard et al. 1998). CH₃ is one of the most important radicals in the hydrocarbon photochemistry because it is the primary product of methane photolysis and plays an essential role in forming C₂H₆, the most abundant and stable C₂ species. A fundamental understanding of the distribution of CH₃ provides unique insights into the chemistry of hydrocarbons as well as comparative planetology.

Derived from text

Photochemical Reactions; Solar System; Planetary Atmospheres; Infrared Space Observatory (Iso); Chemical Reactions

20030066513 NASA Marshall Space Flight Center, Huntsville, AL, USA

An Alternative Hypothesis for How Microgravity Improves Macromolecular Crystal Quality

Pusey, Marc; [2003]; 1 pp.; In English; American Crystallographic Association, 27 Jul. 2003, Covington, KY, USA; No Copyright; Avail: Other Sources; Abstract Only

There is a substantial body of experimental evidence, from this and other laboratories, that strongly suggests that for many proteins crystal nucleation and growth is by addition of associated species that are preformed by reversible concentration-driven self association processes in the bulk solution. We have developed a self-association model for the crystal nucleation and growth of the protein chicken egg lysozyme. The model accounts for the obtained crystal symmetry, explains the observed surface structures, and shows the importance of the symmetry obtained by self-association in solution to the process as a whole. This model also offers a possible mechanism for fluid flow effects on the growth process and how microgravity may affect it. While a single lysozyme molecule is relatively small an octamer in the 43 helix configuration (the proposed average sized growth unit) would have a M.W. approx. 115,000 and dimensions of 5.6 x 5.6 x 7.6 nm. Direct AFM measurements of growth unit incorporation indicate that units as wide as 11.2 nm and as long as 11.4 nm (a 24-mer) commonly attach to the crystal. AFM results from Weichmann et al. (Ultramicroscopy 86, 159-166, 2001) suggest that associated species of up to 40-mers in size add to the (101) faces. These measurements reflect the sizes of units that both added and desorbed from the crystal surface. The larger and less isotropic the associated species the more likely that it will be oriented to some degree in a flowing boundary layer, even at the low flow velocities measured about macromolecule crystals. On Earth, concentration gradient driven flow will maintain a high interfacial concentration, i.e., a high level (essentially that of the bulk solution) of solute association at the interface and higher growth rate. Higher growth rates mean an increased probability that misaligned growth units are trapped by subsequent growth layers before they can be desorbed and try again, or that the desorbing species is more likely to be smaller than the adsorbing species. In microgravity the extended diffusive boundary layer will lower the interfacial concentration. This results in a net dissociation of aggregated species that diffuse in from the bulk solution, i.e., smaller associated species, which are more likely able to make multiple attempts to correctly bind, yielding higher quality crystals.

Author

Crystal Growth; Microgravity; Diffusivity; Fluid Flow; Macromolecules; Crystal Surfaces

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ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20030066518 NASA Marshall Space Flight Center, Huntsville, AL, USA

The Formation of Relativistic Jets from Kerr Black Holes

Nishikawa, K.-I.; Richardson, G.; Preece, R.; Hardee, P.; Koide, S.; Shibata, K.; Kudoh, T.; Sol, H.; Fishman, G. J.; [2003]; 1 pp.; In English; Particle Acceleration in Astrophysical Objects, 24-28 Jun. 2003, Cracow, Poland; No Copyright; Avail: Other Sources; Abstract Only

We have performed the first fully three-dimensional general relativistic magnetohydrodynamics (GRMHD) simulation for Schwarzschild and Kerr black holes with a free falling corona and thin accretion disk. The initial simulation results with a Schwarzschild metric show that a jet is created as in the previous axisymmetric simulations with mirror symmetry at the equator. However, the time to form the jet is slightly longer than in the 2-D axisymmetric simulation. We expect that the dynamics of jet formation are modified due to the additional freedom in the azimuth dimension without axisymmetry with respect to the Z axis and reflection symmetry respect to the equatorial plane. The jet which is initially formed due to the twisted magnetic fields and shocks becomes a wind at the later time. The wind flows out with a much wider angle than the initial jet. The twisted magnetic fields at the earlier time were untwisted and less pinched. The accretion disk became thicker than the initial condition. Further simulations with initial perturbations will provide insights for accretion dynamics with instabilities such as magneto-rotational instability (MRI) and accretion-eject instability (AEI). These instabilities may contribute to variabilities observed in microquasars and AGN jets.

Author

Accretion Disks; Magnetohydrodynamics; Black Holes (Astronomy); Perturbation; Magnetic Field Configurations; Schwarzschild Metric; Quasars

20030067437 Massachusetts Inst. of Tech., Cambridge, MA, USA

Orbital-Phase-Resolved Study of OAO 1657-415 in Spin-Up and Spin-Down

Chakrabarty, Deepto; [2003]; 1 pp.; In English

Contract(s)/Grant(s): NAG5-4805

Report No.(s): MIT-6627400; No Copyright; Avail: Other Sources; Abstract Only

We observed the 38-s X-ray pulsar OAO 1657-415 in a series of daily snapshots spanning its 10-day binary orbit, on three different occasions corresponding to different accretion torque states. The goal was to see if the previously observed drastic variability in X-ray spectral properties showed a systematic pattern with respect to orbital phase or torque state. Our study failed to identify any systematic patterns, although considerably stochastic variability was observed. Overall, our results were inconclusive. We chose not to prepare a journal paper on this study, although the data were shared with several other groups interested in monitoring the properties of this source.

Author

Oao; Pulsars; X Ray Astronomy; Binary Stars

20030067601 Smithsonian Astrophysical Observatory, Cambridge, MA, USA

Coronal Activity in the R CrA T Association

Patten, Brian M.; Oliverson, Ronald J., Technical Monitor; July 2003; 2 pp.; In English

Contract(s)/Grant(s): NAG5-11321

Report No.(s): Rept-2; No Copyright; Avail: CASI; [A01](#), Hardcopy

For this project we intend to extract net counts and variability information for the X-ray sources found in 9 archival ROSAT PSPC and 6 archival ROSAT HRI images in the region of the R CrA T association. These data will be merged with an extensive database of optical photometry and spectroscopy plus published near-infrared photometry to (1) identify new association members and (2) derive, for the first time, an accurate coronal luminosity function for the T Tauri members of this T association. These data will be used to make direct comparisons between the coronal luminosity functions for other T associations and those of large clusters to assess (a) the importance of the star-formation environment in initial coronal activity levels, (b) the effects of PMS evolution on dynamo activity as a function of mass and age, and (c) the level of contamination by field post-T Tauri stars on association membership surveys.

Derived from text

Rosat Mission; Coronas; Astrophysics; Research Projects; X Ray Astronomy

20030067603 Polish Academy of Sciences, Warsaw, Poland

Understanding the Long-Term Spectral Variability of Cygnus X-1 with Burst and Transient Source Experiment and All-Sky Monitor Observations

Zdziarski, Andrzej A.; Poutanen, Juri; Paciesas, William S.; Wen, Lin-Qing; The Astrophysical Journal; 10 October 2002, pp. 357-373; In English

Contract(s)/Grant(s): KBN-5P03D00821; KBN-2P03C00619p1,2; Copyright; Avail: Other Sources

We present a comprehensive analysis of all observations of Cyg X-1 by the Compton Gamma Ray Observatory Burst and Transient Source Experiment (BATSE; 20-300 keV) and by the Rossi X-Ray Timing Explorer all-sky monitor (ASM; 1.5-12 keV) until 2002 June, including approximately 1200 days of simultaneous data. We find a number of correlations between fluxes and hardnesses in different energy bands. In the hard (low) spectral state, there is a negative correlation between the ASM 1.5-12 keV flux and the hardness at any energy. In the soft (high) spectral state, the ASM flux is positively correlated with the ASM hardness but uncorrelated with the BATSE hardness. In both spectral states, the BATSE hardness correlates with the flux above 100 keV, while it shows no correlation with the 20-100 keV flux. At the same time, there is clear correlation between the BATSE fluxes below and above 100 keV. In the hard state, most of the variability can be explained by softening the overall spectrum with a pivot at approximately 50 keV. There is also another, independent variability pattern of lower amplitude where the spectral shape does not change when the luminosity changes. In the soft state, the variability is mostly caused by a variable hard (Comptonized) spectral component of a constant shape superposed on a constant soft blackbody component. These variability patterns are in agreement with the dependencies of the rms variability on the photon energy in the two states. We also study in detail recent soft states from late 2000 until 2002. The last of them has lasted thus far for more than 200 days. Their spectra are generally harder in the 1.5-5 keV band and similar or softer in the 3-12 keV band than the spectra of the 1996 soft state, whereas the rms variability is stronger in all the ASM bands. On the other hand, the 1994 soft state transition observed by BATSE appears very similar to the 1996 one. We interpret the variability patterns in terms of theoretical Comptonization models. In the hard state, the variability appears to be driven mostly by changing flux in seed photons Comptonized in a hot thermal plasma cloud with an approximately constant power supply. In the soft state, the variability is consistent with flares of hybrid, thermal/nonthermal, plasma with variable power above a stable cold disk. The spectral and timing differences between the 1996 and 2000-2002 soft states are explained by a decrease of the color disk temperature. Also, on the basis of broadband pointed observations simultaneous with those of the ASM and BATSE, we find the intrinsic bolometric luminosity increases by a factor of approximately 3-4 from the hard state to the soft one, which supports models of the state transition based on a change of the accretion rate.

Author

Cygnus Constellation; All Sky Photography; Black Holes (Astronomy); Gamma Ray Observatory; Binary Stars; Spectra; Variability

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ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20030066243 Cornell Univ., Ithaca, NY, USA

Investigation of Celestial Solid Analogs

Sievers, A. J.; [2003]; 7 pp.; In English

Contract(s)/Grant(s): NAG5-9140; No Copyright; Avail: CASI; [A02](#), Hardcopy

Our far infrared studies of both hydrophobic and hydrophilic aerogel grains have demonstrated that the mm and sub-mm wave absorption produced by the fundamental two level systems (TLS) mechanism represents a more significant contribution for these open grain structures than for bulk amorphous silicate grains. We found that the region with the anomalous temperature dependence of the spectral index due to the TLS excitations can extend in a fluffy material up to 80 per cm, which is well beyond its typical upper limit for bulk glasses. Currently there is no theoretical explanation for this surprising result. The effects of reduced dimensionality on the optical properties of carbonaceous grains have been studied with a systematic investigation of carbon aerogels. This spectroscopic approach has permitted a more reliable determination of the single grain mass normalized absorption coefficient based on the experimentally determined characteristics of the fluffy material rather than on first principles calculations involving the bulk properties of the substance. Our finding is that the electrical connectivity of the material is the main factor affecting its far infrared absorption coefficient. Another one of the main constituents of the interstellar dust, amorphous ice, has been investigated in the mm-wave region both in the high (HDA) and low (LDA) density amorphous phases and as a function of impurities. We found that doping either phase with ionic (LiCl) or molecular

(methanol) impurities decreases the difference in the mm-wave absorption coefficient between the HDA and LDA ice phases so that the HDA spectrum can be used as an analog for impure ice absorption in the far infrared spectral region.

Author

Aerogels; Electromagnetic Absorption; Temperature Dependence; Carbon

20030066274 Massachusetts Inst. of Tech., Cambridge, MA, USA

Timing the Millisecond X-ray Pulsar with RXTE

Chakrabarty, Deepto; January 2003; 1 pp.; In English

Contract(s)/Grant(s): NAG5-9185; No Copyright; Avail: CASI; [A01](#), Hardcopy

The science from this program was published in a paper entitled 'The Erratic Luminosity Behavior of SAX J1808.4-3658 During Its 2000 Outburst'. This paper discussed the unusual outburst lightcurve of this source in early 2000, and contrasted its behavior with the more typical outburst lightcurves observed in other soft X-ray transients. After this grant had expired, some of the data products generated in this program were also mentioned in two more recent papers entitled 'Nuclear-Powered Millisecond Pulsars and the Maximum Spin Frequency of Neutron Stars' and 'Kilohertz Quasi-Periodic X-Ray Brightness Fluctuations from an Accreting Millisecond Pulsar'.

Author

Time Measurement; Pulsars; X Ray Astronomy

20030066278 Massachusetts Inst. of Tech., Cambridge, MA, USA

XMM Observations of X-Ray Emission from Supernovae

Immler, Stefan; Lewin, Walter; August 13, 2003; 1 pp.; In English

Contract(s)/Grant(s): NAG5-11930

Report No.(s): MIT-6893270; No Copyright; Avail: Other Sources; Abstract Only

Of the six proposed targets, only one observation was performed. The observation resulted in a 28ks observation of SN 1998S. At the time of writing the proposal, our target list only contained previously unknown X-ray supernovae. Between submission of the proposal and the actual observation, a Chandra DDT observation resulted in the detection of SN 1998S. Since SN 1998S was observed with Chandra five times before the XMM-Newton observation was made, the data did not yield enough new information to warrant a separate SN 1998S publication. The key science results of that observation were presented in a review article (by Immler and Lewin); the results were also presented at two conferences.

Author

X Ray Astronomy; Supernovae; Emission

20030066363 Harvard Univ., Cambridge, MA, USA

Origin of Dips in 4U1915-05

Grindlay, Jonathan E.; June 17, 2003; 2 pp.; In English

Contract(s)/Grant(s): NAG5-10040; No Copyright; Avail: CASI; [A01](#), Hardcopy

This grant supported our participation in a proposal submitted by Didier Barret to conduct a study of the dipping LMXB 4U1915-05. In this Final Report, we summarize the Scientific Objectives of this investigation and the results achieved. Data analysis is still in progress and publication of results will be forthcoming. Our objectives in this work have been to study: 1. Spectra of dips in 4U1915-05: This low mass x-ray binary (LMXB) is a 50min binary system and the first to show x-ray dip behaviour. Our XMM observation was proposed to study the x-ray spectra of the dips to better constrain their physical properties. Of primary interest is the variation of the absorbing column density as a function of flux in the dip. We wish to isolate the absorption from Compton scattering components in the dip spectra, and to use the large throughput of XMM to better constrain short timescale variations of the spectrum in the dips. 2. Period of the dips and long-term ephemeris: We also seek to improve upon the long-term ephemeris of the dips by combining these more recent XMM data with earlier RXTE data to update the ephemeris for dips and the determination of the dip period to further test whether the dip period represents the true binary period of this LMXB. We shall extend the ephemeris published by Chou, Grindlay and Blosner 2001, ApJ, 549, 1135) to test the assertion of Retter, Chou et al 2002, MNRAS, 330, 37 that the dips are indeed the binary period and not a precession period. 3 Results Achieved The observations for this program were delayed, presumably for reasons related to the general difficulty of scheduling XMM targets in this region moderately close to the Cygnus region. 4 171916-05 was finally observed (21ksec) on April 24, 2002, but the data have not been delivered. A second observation was conducted on September 9, 2002 (18ksec) and the data are still being analyzed. 4 Papers Presented and Published A paper is in preparation

for Astronomy and Astrophysics in which the full results of this investigation will be reported. 1. Barret, D. et al 2003, Astron. and Astrophys., in press. 2

Author

X Ray Astronomy; X Ray Spectra; X Ray Binaries

20030066511 NASA Marshall Space Flight Center, Huntsville, AL, USA

Analysis Methods and Results for Weak Gamma-Ray Bursts in the BATSE Data

Mitrofanov, I. G.; Anfimov, D. S.; Briggs, M. S.; Fishman, G. J.; Kippen, R. M.; Litvak, M. L.; Meegan, C. A.; Paciesas, W. S.; Preece, R. D.; Sanin, A. B.; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

We report initial results on the statistical properties of the dimmest gamma-ray bursts (GRBs) observed with the Burst and Transient Source Experiment (BATSE), using new ground-based methods to obtain a sample of GRBs from 502 days of BATSE data. Using the most sensitive ground-based detection of GRBs, the sample extends to GRBs much fainter than those detected by the on-board trigger, but because of the temporal resolution of the data, the sample is limited to GRBs of duration of at least 2(approx.)s. For each detected event, Bayesian probabilities are calculated for the event to belong to each of seven classes of differing physical origins. The sample of GRB candidates is defined by the requirement that the Bayesian probability for belonging to the GRB class is higher than 0.5. The intensity distribution of the GRB sample is corrected using a Monte Carlo simulation of the post-flight detection efficiency. The dimmest BATSE bursts of the sample continue the hardness-intensity trend seen in brighter GREs and are consistent with isotropy.

Author

Gamma Ray Bursts; Monte Carlo Method; Temporal Resolution; Statistical Distributions; Actuators

20030066545 Arizona State Univ., Tempe, AZ, USA

Investigating the Role of Glass in Martian Spectra

Minitti, Michelle E.; Hamilton, Victoria E.; Wyatt, Michael B.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The martian surface is dominated by igneous materials whose mineralogy and composition have been investigated through remote sensing studies. MGS TES identified two major spectral shapes that dominate the dark regions of Mars. The spectral type interpreted as plagioclase-rich basalt occurs almost exclusively in dark regions of the southern highlands and Syrtis Major while the spectral type interpreted as plagioclase- and glass-bearing andesite (or basaltic andesite) is found in dark regions across the planet. The interpretation of the latter spectral shape as andesitic largely depends on the SiO₂-rich nature of the glassy component utilized in deconvolutions of TES spectra. The compositions of the glasses utilized in the TES deconvolutions originate from analyses of interstitial glasses found in andesitic rocks. However, these interstitial glass compositions may not be relevant to the mafic lithologies observed by TES in southern highland and Syrtis Major dark regions and present in the current collection of the martian meteorites. How do the compositions and spectral properties of interstitial glasses present in mafic materials compare to those of glasses currently available as deconvolution endmembers? Could incorporation of new glass endmembers into deconvolutions of TES spectra alter conclusions about the mineralogy and composition of dark region materials? This work seeks to answer these questions by establishing the compositions and spectral characters of interstitial glasses relevant to mafic igneous rocks on Mars.

Derived from text

Glass; Spectra; Mars Environment; Silicon Dioxide

20030066546 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Seasonal Mapping of HDO and H₂O in the Martian Atmosphere

Mumma, M. J.; Novak, R. E.; DiSanti, M. A.; Bonev, B.; DelloRusso, N.; Magee-Sauer, K.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations Contract(s)/Grant(s): NSF AST-02-05397; RTOP 344-32-30-10; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

We report investigations of HDO and H₂O on Mars using CSHELL at the NASA IRTF, on dates that span an entire Mars year. Our objective is to understand whether deuterium is preferentially sequestered in the polar regions, and to determine whether the two polar caps are equivalent in that regard. The instrument slit is typically positioned N-S along the central meridian resulting in a one-dimensional map of HDO (1997- 2003) and/or H₂O (2001-2003). Column burdens are extracted

at one arc-second intervals along the slit, permitting a direct comparison of the D/H ratio at various latitudes and seasons.
Derived from text

Mars Atmosphere; Water; Seasons; Deuterium Compounds; Heavy Water

20030066589 Field Museum of Natural History, Chicago, IL, USA

Tungsten Isotopic Compositions of the SNC Meteorites: Further Implications for Early Differentiation History of Mars

Foley, C. N.; Wadhwa, M.; Janney, P. E.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The hafnium-tungsten (Hf-182 - W-182) short-lived chronometer ($t_{1/2}$ approx. 9 Myr) has been used to date the timing of early metal-silicate differentiation events on the Earth, Moon, Mars (SNC parent body), and Vesta (eucrite parent body). Both hafnium and tungsten are highly refractory elements that are present in approximately chondritic relative abundances in bulk planets and planetesimals. However, during metal-silicate differentiation (or core formation), the lithophile Hf segregates into the silicate fraction while the siderophile W segregates into the metallic core. If this differentiation event occurs within approx. 5 half lives of Hf-182, approx. 45 Myr, then its timing can be determined by measuring the excess of the daughter product, W-182.

Derived from text

Meteoritic Composition; Planets; Composition (Property); Chronometers

20030066610 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Characteristics of Mini-Magnetospheres Formed by Paleo-Magnetic Fields of Mars

Ness, N. F.; Krymskii, A. M.; Crider, D. H.; Breus, T. K.; Acuna, M. H.; Hinson, D.; Barashyan, K. K.; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The intensely and non-uniformly magnetized crustal sources generate an effective large-scale magnetic field. In the Southern hemisphere the strongest crustal fields lead to the formation of large-scale mini-magnetospheres. In the Northern hemisphere, the crustal fields are rather weak and there are only isolated mini-magnetospheres. Re-connection with the interplanetary magnetic field (IMF) occurs in many localized regions. This may occur not only in cusp-like structures above nearly vertical field anomalies but also in halos extending several hundreds of kilometers from these sources. Re-connection will permit solar wind (SW) and more energetic particles to precipitate into and heat the neutral atmosphere. Electron density profiles of the ionosphere of Mars derived from radio occultation data obtained by the Radio Science Mars Global Surveyor (MGS) experiment are concentrated in the near polar regions. The effective scale-height of the neutral atmosphere density in the vicinity of the ionization peak has been derived for each of the profiles studied. The effective scale-heights have been compared with the crustal magnetic fields measured by the MGS Magnetometer/Electron Reflectometer (MAG/ER) experiment. A significant difference between the large-scale mini-magnetospheres and regions outside of them has been found. The neutral atmosphere is cooler inside the large-scale mini-magnetospheres. It appears that outside of the cusps the strong crustal magnetic fields prevent additional heating of the neutral atmosphere by direct interaction of the SW. The scale-height of the neutral atmosphere density derived from the experiment with the MGS Accelerometer has been compared with MAG/ER data. The scale-height was found to be usually larger than mean value near the boundaries of potential mini-magnetospheres and around cusps. It may indicate that the paleo-magnetic/IMF field re-connection is characteristic of the mini-magnetospheres at Mars.

Derived from text

Magnetometers; Crusts; Interplanetary Magnetic Fields; Energetic Particles

20030066616 Arizona State Univ., Tempe, AZ, USA

Basaltic Andesite or Weathered Basalt: A New Assessment

Ruff, S. W.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

One of the most significant results to emerge from the Mars Global Surveyor Thermal Emission Spectrometer (TES) is the observation of two distinct thermal infrared (TIR) spectral units in the low albedo regions of Mars. One of these units has the spectral characteristics of a plagioclase- and pyroxene-rich flood basalt and is found mostly in the southern highlands (Syrtis-type). The second unit, which is concentrated in the northern lowlands but is distributed across the highlands as well,

has been characterized as a plagioclase- and glass-rich basaltic andesite (Acidalia-type). While the basaltic identification for the Syrtis-type spectrum is accepted widely, the andesitic characterization of the Acidalia-type spectrum is the source of considerable debate. One reason for this debate is the argument that the production of voluminous andesite requires plate-tectonic subduction, which is lacking on Mars. Several alternative hypotheses have been presented to explain the apparent andesitic character of the Acidalia-type spectrum. These include: oxidation and recrystallization of a SNC-type basalt; weathering of basalt to produce clay minerals; silica coating on basalt; and palagonitization of basalt. In all of these cases it has been shown that alteration of a precursor basalt can yield a spectrum that resembles the Acidalia-type spectrum. While such explanations dispense with the idea of large volumes of basaltic andesite on Mars, they require a process by which some of the basaltic materials on Mars become altered while some remain relatively pristine. The basis for the ambiguity in the basaltic andesite identification lies in the fact that mineral glasses, both volcanic or authigenic, and some clay minerals have significant spectral overlap in the TIR wavelengths. Recently it has been shown that some zeolites and palagonites also have overlapping spectral features. While it may be impossible to differentiate unambiguously between some of these candidates because their spectral differences are so subtle, in other cases it may be more feasible. As was noted, some of the candidate clay minerals for Mars have distinctive spectral characteristics in a portion of the TIR spectrum that has been excluded in atmospherically-corrected TES spectra because of the absorption of atmospheric CO₂. The excluded region is wider than necessary in an effort to avoid the confounding effects of CO₂. However, CO₂ opacity remains relatively low in the region of the critical distinguishing features between clay minerals and glasses. Careful scrutiny of non-atmospherically-corrected TES spectra may serve to distinguish between the two. This work presents an initial assessment of whether montmorillonite and some other clay minerals are present on the martian surface. While such work is not sufficient to settle the andesite debate, it does shed light on the viability of some of the alternative hypotheses.

Derived from text

Basalt; Andesite; Thermal Emission; Infrared Radiation; Montmorillonite; Silicon Dioxide; Clays; Mars Surface

20030066626 NASA Ames Research Center, Moffett Field, CA, USA

CRISM: Compact Reconnaissance Imaging Spectrometer for Mars on the Mars Reconnaissance Orbiter

Murchie, S.; Arvidson, R.; Beisser, K.; Bibring, J.-P.; Bishop, J.; Boldt, J.; Bussey, B.; Choo, T.; Clancy, R. T.; Darlington, E. H., et al.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) on the Mars Reconnaissance Orbiter (MRO) will conduct a comprehensive series of investigations of the Martian surface and atmosphere. The investigations will be accomplished using an instrument design that provides high spatial and spectral resolutions, extended wavelength range, and ability to gimbal through a range of orientations. Baseline investigations include a near-global survey to find high science priority sites, full-resolution measurement of thousands of such sites, and tracking of seasonal variations in atmospheric and surface properties.

Derived from text

Imaging Spectrometers; Mars Surface; Mars Atmosphere; Meteorological Parameters

20030066635 Brown Univ., Providence, RI, USA

Olympus Mons Fan Shaped Deposit Morphology: Evidence for Debris Glaciers

Milkovich, S. M.; Head, J. W., III; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Olympus Mons is the largest volcano on Mars, rising over 25 km above the surrounding plains and with a basal diameter greater than 600 km. It is surrounded by a basal escarpment up to 6 km tall. Extending up to 1000 km beyond this scarp are lobes of ridged materials known as the aureole. Superimposed upon the west and northwest aureole deposits at the base of the escarpment are lobate features which are often interpreted to be landslide debris aprons. In 1981, Lucchitta demonstrated that the morphology of these marginal fan shaped deposits as revealed in Viking imagery is very similar to terrestrial glaciers. The location of these deposits is shown. The fan shaped deposits found on the northwest flank of Olympus Mons show long, even, curvilinear ridges which are subparallel to the deposit margins. These ridges sharply contrast with those associated with landslide deposits, which are characterized by longitudinal grooves or transverse ridges. The ridges on the northwest flank debris apron exhibit similar morphology to ridges of moraine material found near the margins of terrestrial glaciers. An additional deposit found at the base of the west scarp displays a tongue-shaped center with subparallel lobate ridges towards the margins. These ridges are superposed on the surrounding aureole and are not deflected by the topography; thus Lucchitta

interprets them to be draped over the surface as a debris-rich or rock glacier decayed. In this study we expand upon Lucchitta's hypothesis. A range of glacial emplacement mechanisms are considered.

Derived from text

Glacial Drift; Mars Volcanoes; Morphology; Topography

20030066636 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Vertical Distribution of Shallow Water in the Distinguishable Regions at Low and High Latitudes of Mars: Neutron Data Deconvolution of HEND

Mitrofanov, I. G.; Litvak, M. L.; Kozyrev, A. S.; Sanin, A. B.; Tretakov, V.; Boynton, W. V.; Hamara, D. K.; Shinohara, C.; Saunders, R. S.; Drake, D., et al.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

High Energy Neutron Detector (HEND) is the part of Gamma-Ray Spectrometer suite onboard NASA Mars Odyssey orbiter [1-4]. During 16 months of mapping stage of Odyssey mission HEND has accumulated the set of maps of neutron emission of Mars at more than seven decades of energies range from the Cadmium threshold of 0.4 eV up to 15 MeV. These maps present very large variations of neutrons at different regions of Mars and they also show quite strong changes along Martian seasons.

Derived from text

Vertical Distribution; Shallow Water; Mars Surface; Tropical Regions

20030066637 Brown Univ., Providence, RI, USA

Geological Evidence for Recent Martian Ice Ages

Mustard, J. F.; Head, J. W.; Kreslavsky, M. A.; Milliken, R. E.; Marchant, D. R.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Recent exploration of Mars has revealed abundant water ice in near-surface deposits of the mid-to high latitudes in both hemispheres. Here we show evidence that these near-surface, water-ice rich units represent a mixture of ice and dust that is layered, meters thick, and latitude dependent. These units were formed during a geologically recent major martian ice age, and were emplaced in response to the changing stability of water ice and dust on the surface during variations in orbital parameters. Evidence for these units include a smoothing of topography at subkilometer baselines from about 30 deg. north and south latitudes to the poles, a distinctive dissected texture in MOC images in the +/-30 deg.- 60 deg. latitude band, latitude-dependent sets of topographic characteristics and morphologic features (e.g., polygons, 'basketball' texture, gullies, viscous flow features), and hydrogen concentrations consistent with the presence of abundant ice at shallow depths above 60 deg. latitude. The most equatorward extent of these ice-rich deposits was emplaced during the last major martian ice age between 0.4 and 2 Myrs, down to latitudes of 30 deg. Mars is currently in an 'interglacial' period and the ice-rich deposits between 30-60 are presently undergoing reworking, degradation and retreat in response to the current stability relations of near-surface ice. Unlike Earth, martian ice ages are characterized by warmer climates in the polar regions and the enhanced role of atmospheric ice and dust transport and deposition to produce widespread and relatively evenly distributed smooth deposits at mid-latitudes during orbital extremes.

Derived from text

Mars Surface; Ice; Deposition

20030066639 Paris-Sud Univ., Orsay, France

The Composition of Martian Low Albedo Regions Revisited

Poulet, F.; Erard, S.; Mangold, N.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Low albedo regions on Mars are often interpreted as outcrops of volcanic rocks. Mineral models of the thermal emission spectra obtained by TES indicate that the martian dark regions are characterized by basaltic surface material: large fraction of feldspar and one high-calcium pyroxene. The data from the IR spectrometer ISM onboard Phobos-2 show that the composition of these layers is rich in pyroxenes and contains a significant signature of hydration. A systematic comparison of TES and ISM data suggests that variations in the vis-NIR observations could be controlled by dust or other thermally neutral materials. The purpose of this work is to revisit the surface composition of dark regions by modeling ISM spectra

representative of dark regions with a radiative transfer theory and taking in account new high resolution images which give a new view of the surface texture of these regions. Syrtis Major and dark spots inside chasmata of Valles Marineris are of particular interest. Even if it is important to remember that the different observational techniques (visible, NIR and thermal) are sensitive to different characteristics of the martian surface, the understanding of discrepancies of the compositional analysis from different measurements and the nature of low albedo layers is essential 1- to understand their erosional history, and 2- to interpret the IR data of future spectrometers like OMEGA and PFS onboard Mars Express.

Derived from text

Albedo; Composition (Property); Mars Exploration; Thermal Emission; Emission Spectra

20030066642 Arizona Univ., Tucson, AZ, USA

Identification of Topographically-controlled Thermal Tidal Modes in the Martian Upper Atmosphere

Withers, Paul; Bougher, S. W.; Keating, G. M.; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Mars Global Surveyor (MGS) accelerometer (ACC) observations of the martian upper atmosphere have revealed large variations in density with longitude during northern hemisphere spring at altitudes of 130 - 160 km, all latitudes, and midafternoon local solar times (LSTs). This zonal structure is due to tides from the surface. The zonal structure is stable on timescales of weeks, decays with increasing altitude above 130 km, and is dominated by wave-3 (average amplitude 22% of mean density) and wave-2 (18%) harmonics. We use a simple application of classical tidal theory to identify the dominant tidal modes and obtain results consistent with those of General Circulation Models. Our method is less rigorous, but simpler, than the General Circulation Models and hence complements them. Topography has a strong influence on the zonal structure.

Derived from text

Atmospheric General Circulation Models; Mars Atmosphere; Topography; Tides; Upper Atmosphere

20030066643 NASA Johnson Space Center, Houston, TX, USA

The Miniaturized Moessbauer Spectrometer MIMOS II of the Athena Payload for the 2003 MER Missions

Klingelhofer, G.; Morris, R. V.; deSouza, P. A., Jr.; Bernhardt, B.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

A first-order requirement of spacecraft missions that land on Mars is instrumentation for in situ mineralogical analysis. Moessbauer Spectroscopy is a powerful tool for quantitative analysis of Fe-bearing materials. The Athena Moessbauer spectrometer MIMOS II on the martian surface will provide: (1) identification of iron-bearing phases (e.g., oxides, silicates, sulfides, sulfates, and carbonates), (2) quantitative measurement of the distribution of iron among its oxidation states (e.g., Fe(2+)/Fe(3+) ratio), and (3) quantitative measurement of the distribution of iron among iron-bearing phases (e.g., the relative proportions of iron in olivine, pyroxene, and magnetite in a basalt) in rocks and soils. Moessbauer data will also be highly complementary with chemical analyses from the APXS and the Mini-TES compositional data. Mars is a particularly good place to do Moessbauer mineralogy because its surface is iron rich (approx. 20% Fe as Fe₂O₃). Moessbauer spectrometers that are built with backscatter measurement geometry require no sample preparation, a factor important for in situ planetary measurements.

Derived from text

Miniaturization; Design Analysis; In Situ Measurement; Spectrometers; Mineralogy; Chemical Analysis; Mars Surface

20030066645 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Volatile Cycling and Layering on Mars: Observations, Theory and Modeling

Mischna, M. A.; McCleese, D. J.; Richardson, M. I.; Vasavada, A. R.; Wilson, R. J.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

With the release of Mars Odyssey Gamma Ray Spectrometer (GRS) results, which indicate the presence of vast reservoirs of near-surface ice in the martian polar regions, we are presented with an exquisite dilemma. These deposits, which are present as far down as 60 deg. latitude in both hemispheres, are consistent with the suggestion of thermal models that ice will be best protected in these extended regions during periods of higher obliquity. However, the current paradigm regarding the placement of these deposits, i.e., diffusive deposition of water vapor, appears to be inconsistent with the large volume mixing ratios (approx. 70%) inferred from the GRS data. This apparent conflict argues that diffusion alone cannot be the primary mechanism

for the creation of these reservoirs, and that an alternate, large-scale process should be considered.

Derived from text

Cycles; Deposits; Ice; Mars Surface

20030066646 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Polar Dunes Resolved by the Mars Orbiter Laser Altimeter Gridded Topography and Pulse Widths

Neumann, Gregory A.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; **C01**, CD-ROM; **A01**, Hardcopy; Available on CD-ROM as part of the entire parent document

The Mars Orbiter Laser Altimeter (MOLA) polar data have been refined to the extent that many features poorly imaged by Viking Orbiters are now resolved in densely gridded altimetry. Individual linear polar dunes with spacings of 0.5 km or more can be seen as well as sparsely distributed and partially mantled dunes. The refined altimetry will enable measurements of the extent and possibly volume of the north polar ergs. MOLA pulse widths have been recalibrated using inflight data, and a robust algorithm applied to solve for the surface optical impulse response. It shows the surface root-mean-square (RMS) roughness at the 75-m-diameter MOLA footprint scale, together with a geological map. While the roughness is of vital interest for landing site safety studies, a variety of geomorphological studies may also be performed. Pulse widths corrected for regional slope clearly delineate the extent of the polar dunes. The MOLA PEDR profile data have now been re-released in their entirety (Version L). The final Mission Experiment Gridded Data Records (MEGDR's) are now provided at up to 128 pixels per degree globally. Densities as high as 512 pixels per degree are available in a polar stereographic projection. A large computational effort has been expended in improving the accuracy of the MOLA altimetry themselves, both in improved orbital modeling and in after-the-fact adjustment of tracks to improve their registration at crossovers. The current release adopts the IAU2000 rotation model and cartographic frame recommended by the Mars Cartography Working Group. Adoption of the current standard will allow registration of images and profiles globally with an uncertainty of less than 100 m. The MOLA detector is still operational and is currently collecting radiometric data at 1064 nm. Seasonal images of the reflectivity of the polar caps can be generated with a resolution of about 300 m per pixel.

Derived from text

Data Acquisition; Dunes; Polar Caps; Topography; Surface Roughness; Laser Altimeters

20030067208 Stanford Univ., Stanford, CA

Controlled Precipitation of Radiation Belt Particles

Bell, Timothy F.; Mar. 24, 2003; 39 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-99-1-0339

Report No.(s): AD-A413487; AFRL-SR-AR-TR-03-06159; No Copyright; Avail: CASI; **A03**, Hardcopy

The overall objectives of this work were to quantify the requirements for controlled precipitation of radiation belt particles in order to mitigate enhanced space particle effects, to address critical issues of antenna-plasma coupling, and to develop a model of the effective radiated power throughout the magnetosphere. In carrying out this effort, Stanford University worked closely with AFRL/VSB. During the period of performance, Stanford University concentrated on the critical issues which determine the properties of the ion and electron sheaths which surround dipole antennas in a plasma. The accurate modeling of the ion and electron sheaths and their effects on the far-field pattern of the antenna is necessary in order to simulate the characteristics of an antenna radiating at ELF/VLF frequencies in the magnetosphere.

DTIC

Radiation Belts; Dipole Antennas; Plasma Sheaths; Radio Frequency Interference

20030067381 NASA Marshall Space Flight Center, Huntsville, AL, USA

Evidence for Spiral Magnetic Structures at the Magnetopause: A Case for Multiple Reconnections

Vaisberg, O. L.; Smirnov, V. N.; Avakov, L. A.; Moore, T. E.; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

We analyze plasma structures within the low latitude boundary layer (LLBL) observed by the Interball Tail spacecraft under southward interplanetary magnetic field. Ion velocity distributions observed in the LLBL under these conditions fall into three categories: (a) D-shaped distributions, (b) ion velocity distributions consisting of two counterstreaming magnetosheath-type, and (c) distributions with three components where one of them has nearly zero velocity parallel to magnetic field (VII), while the other two are counter-streaming components. D-shaped ion velocity distributions (a) correspond to magnetosheath plasma injections into reconnected flux tubes, as influenced by spacecraft location relative to the reconnection site.

Simultaneous counter-streaming injections (b) suggest multiple reconnections. Three-component ion velocity distributions (c) and their evolution with decreasing number density in the LLBL are consistent with behavior expected on long spiral flux tube islands at the magnetopause as has been proposed and found to occur in magnetopause simulation. We interpret these distributions as a natural consequence of the formation of spiral magnetic flux tubes consisting of a mixture of alternating segments originating from the magnetosheath and magnetospheric plasmas. We suggest that multiple reconnections play an important role in the formation of the LLBL.

Author

Boundary Layers; Ion Distribution; Magnetopause; Space Plasmas

20030067405 NASA Ames Research Center, Moffett Field, CA, USA

Hydrodynamic Instability and Enhanced Transport in Protoplanetary Nebulae

Richard, Denis T.; [2003]; 1 pp.; In English; 35th DPS Annual Meeting, 2-6 Sep. 2003, Monterey, CA, USA

Contract(s)/Grant(s): RTOP 274-00-02-44; No Copyright; Avail: Other Sources; Abstract Only

The nature of turbulence (and the enhanced transport it provides) is a key element to comprehend the dynamics, physics and chemistry of the protoplanetary nebulae and consequently the planet formation process. Early accretion disk models postulated the turbulent transport through the well-known 'alpha-viscosity' model, introduced by Shakura and Sunyaev in 1973. Since then, the nature of the turbulence in disks has been a subject of investigation. In 1991, the rediscovery by Balbus and Hawley of Chandrasekhar's linear instability in magnetized disks was a breakthrough in the discipline. Unfortunately, the mechanisms leading to turbulence in non-magnetized disks, such as protoplanetary nebulae, remain poorly understood. We will present results from laboratory experiments along with analytical arguments showing that, despite skepticism in the Astrophysical community, differential rotation may indeed be sufficient to trigger and sustain turbulence. We will also propose an alternative viscosity prescription derived from both experiments and analysis.

Author

Nebulae; Turbulence; Planetary Evolution

20030067420 NASA Ames Research Center, Moffett Field, CA, USA

The Organic Component of Interstellar Dust

Pendleton, Yvonne; [2003]; 1 pp.; In English; The Astrophysics of Dust Conference, 25-30 May 2003, Estes Park, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

The distribution, chemical structure, and formation of organic matter in the interstellar medium are important to our understanding of the overall evolution of dust. The exchange of dust between the dense and diffuse interstellar medium, and the effects of processing on dust within dense clouds will affect the inventory of material available for incorporation into newly forming star and planetary systems. Observational ground-based studies have confirmed the widespread distribution of the 3.4 μm absorption band attributed to aliphatic hydrocarbons in the diffuse interstellar medium of our own galaxy, and in the dusty spectra of a few nearby galaxies, while space based observations from ISO probed the signatures of corresponding mid-infrared features. Laboratory experiments which utilize both thermal processes and energetic processing by high energy photons and cosmic rays, produce candidate materials which offer close matches to the observed diffuse interstellar medium and extragalactic hydrocarbon absorption features. Through an analysis of the 4000 to 1000 cm^{-1} (2.5 to 10 micrometers) region of the spectrum of diffuse interstellar medium (DISM) dust compared with the spectra of thirteen chemical entities produced in the laboratory which serve as analogs to the interstellar material, significant constraints have been placed on the applicability of proposed candidate materials to explain the interstellar features. The results indicate that the organic refractory material in the diffuse interstellar medium is predominantly hydrocarbon in nature, possessing little nitrogen or oxygen, with the carbon distributed between the aromatic and aliphatic forms. Long alkane chains $\text{H}_3\text{C}-(\text{CH}_2)_n$ with n much greater than 4 or 5 are not major constituents of this material. Comparisons to laboratory analogs indicate the DISM organic material resembles plasma processed pure hydrocarbon residues much more so than energetically processed ice residues. This result is consistent with a birthsite for the carrier of the 3.4 micrometers band in the outflow region of evolved carbon stars. Comparisons of dust from our own galaxy with that of distant galaxies suggests that the organic component of interstellar dust is widespread and may be an important universal reservoir of prebiotic organic carbon.

Author

Cosmic Dust; Interstellar Matter; Carbon

20030067501 Texas Univ., Austin, TX, USA

Time Series Analysis of the UV Flickering in AGN

Robinson, Edward L.; Welsh, William F.; 2001; 2 pp.; In English

Contract(s)/Grant(s): NAG5-7002; No Copyright; Avail: CASI; [A01](#), Hardcopy

Many active galactic nuclei (AGN) exhibit large-amplitude luminosity fluctuations on short timescales. The fluctuations lead to a profound conclusion: The size of the emitting region is remarkably small. This observational fact is one of the pillars supporting the AGN paradigm: Prodigious amounts of gravitational potential energy are liberated in an accretion disk around a supermassive black hole. The goals of the research were to extract from the IUE Archive the very best observational characterizations of AGN flickering, and to use these to test and develop models for AGN variability. We hoped to answer these specific questions: 1) What does the intrinsic flickering continuum spectrum look like? 2) What do the intrinsic flickering emission-line profiles look like? 3) What is the power spectrum of the flickering? 4) What is the wavelength dependence of the power spectrum? 5) Is the flickering spectrum timescale dependent? and 6) What do the high-order cross correlation functions look like? A short summary of the papers produced by this research is presented.

Derived from text

Active Galactic Nuclei; Continuous Spectra; Flicker; Iue; Time Series Analysis; Astronomical Spectroscopy

20030067612 NASA Marshall Space Flight Center, Huntsville, AL, USA

Sunyaev-Zeldovich Effect Imaging of Macs Galaxy Clusters at $z \geq 0.5$

LaRoque, Samuel; Joy, Marshall; Carlstrom, John E.; Ebeling, Harald; Bonamente, Massimiliano; Dawson, Kyle S.; Edge, Alastair; Holzapfel, William L.; Miller, Amber D.; Nagai, Daisuke, et al.; *Astrophysical Journal*; [2003]; Volume 583, pp. 559-565; In English

Contract(s)/Grant(s): NGT5-50173; NGT8-52906; NAG5-7986; NAG5-8253; HST-HF-0113; NSF 00-96913; Copyright; Avail: Other Sources

We present 30 GHz interferometric Sunyaev-Zeldovich effect (SZE) measurements of a redshift-limited, X-ray-selected cluster sample from the Massive Cluster Survey (MACS). All eight of the high-redshift ($z > 0.5$, $\delta > -15$ deg) galaxy clusters were detected. Additional observations were made at 4.8 GHz with the Very Large Array to help constrain the amount of point source contamination to the SZE decrements. From SZE data alone, we derive electron temperatures in the range 5.5-18.5 keV and total masses between 1.5 and $2.6 \times 10^{14} h$ solar masses within a 65 minute radius (0.28/h Mpc at $z = 0.5$) for the eight clusters. Six of the clusters are MACS discoveries, while two (C10016+1609 and MS 0451.6-0305) were detected by previous X-ray observations and have been recently observed with the Chandra observatory. The X-ray-derived temperatures and masses for C10016+1609 and MS 0451.6-0305 are in good agreement with the SZE derived values. Strong detections of the SZE signal in this sample of MACS objects confirm that they are hot, massive clusters.

Author

Sunyaev-Zeldovich Effect; Galactic Clusters; Sky Surveys (Astronomy); Cosmic Microwave Background Radiation; X Ray Astronomy

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LUNAR AND PLANETARY SCIENCE AND EXPLORATION

Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.

20030066242 NASA Marshall Space Flight Center, Huntsville, AL, USA

Engineering-Level Model Atmospheres for Titan & Neptune

Justus, C. G.; Johnson, D. L.; July 20, 2003; 4 pp.; In English; AIAA Propulsion Conference, 20-23 Jul. 2003, Huntsville, AL, USA

Contract(s)/Grant(s): NAS8-60000; No Copyright; Avail: CASI; [A01](#), Hardcopy

Engineering-level atmospheric models for Titan and Neptune have been developed for use in NASA's systems analysis studies of aerocapture applications in missions to the outer planets. Analogous to highly successful Global Reference Atmospheric Models for Earth (GRAM, Justus et al., 2000) and Mars (Mars-GRAM, Justus and Johnson, 2001, Justus et al., 2002) the new models are called Titan-GRAM and Neptune-GRAM. Like GRAM and Mars-GRAM, an important feature of Titan-GRAM and Neptune-GRAM is their ability to simulate quasi-random perturbations for Monte-Carlo analyses in developing guidance, navigation and control algorithms, and for thermal systems design.

Author

Aerocapture; Titan; Monte Carlo Method; Neptune (Planet); Atmospheric Models

20030066366 Scripps Institution of Oceanography, La Jolla, CA, USA

Extraterrestrial Organic Compounds in Meteorites

Botta, Oliver; Bada, Jeffrey L.; Meyer, Michael, Technical Monitor; Surveys in Geophysics; January 2003; Volume 23, pp. 411-467; In English

Contract(s)/Grant(s): NAG5-4546; Copyright; Avail: Other Sources

Many organic compounds or their precursors found in meteorites originated in the interstellar or circumstellar medium and were later incorporated into planetesimals during the formation of the solar system. There they either survived intact or underwent further processing to synthesize secondary products on the meteorite parent body. The most distinct feature of CI and CM carbonaceous chondrites, two types of stony meteorites, is their high carbon content (up to 3% of weight), either in the form of carbonates or of organic compounds. The bulk of the organic carbon consists of an insoluble macromolecular material with a complex structure. Also present is a soluble organic fraction, which has been analyzed by several separation and analytical procedures. Low detection limits can be achieved by derivatization of the organic molecules with reagents that allow for analysis by gas chromatography/mass spectroscopy and high performance liquid chromatography. The CM meteorite Murchison has been found to contain more than 70 extraterrestrial amino acids and several other classes of compounds including carboxylic acids, hydroxy carboxylic acids, sulphonic and phosphonic acids, aliphatic, aromatic and polar hydrocarbons, fullerenes, heterocycles as well as carbonyl compounds, alcohols, amines and amides. The organic matter was found to be enriched in deuterium, and distinct organic compounds show isotopic enrichments of carbon and nitrogen relative to terrestrial matter.

Author

Meteorites; Chondrites; Interstellar Matter

20030066512 NASA Ames Research Center, Moffett Field, CA, USA

Solar System Connections to the Organic Material In the ISM

Pendleton, Yvonne J.; [2003]; 1 pp.; In English; The IAU General Assembly, 18-30 Jul. 2003, Australia

Contract(s)/Grant(s): RTOP 344-58-12-09; No Copyright; Avail: Other Sources; Abstract Only

The organic component of the interstellar medium (ISM) has relevance to the formation of the early solar nebula, since our solar system formed out of ISM material. Comparisons of near infrared spectra of the diffuse ISM dust with those of primitive solar system bodies (such as comets and meteorites) show a remarkable similarity, suggesting that perhaps some of the interstellar organic material made its way, unaltered, into our solar system. Tracing the interstellar organic material is necessary to understand how these materials may be important links in the development of prebiotic phenomena. Studies of the ISM reveal that the organic refractory component of the diffuse ISM is largely hydrocarbon in nature, possessing little N or O, with carbon distributed between the aromatic and aliphatic forms. There is a strong similarity in the near IR spectra of the diffuse ISM (the 3.4 micron hydrocarbon bands) and those seen in the Murchison and Orgueil meteorites, however, detailed comparisons at longer wavelengths reveal critical dissimilarities. Here we will present comparisons and discussion of relevant spectra. As we continue to explore, we will gain insight into the connection between planetesimals in the solar system and chemistry in the dusty space between the stars.

Author

Interstellar Matter; Near Infrared Radiation; Solar System; Infrared Spectra; Organic Materials

20030066530 Lunar and Planetary Inst., Houston, TX, USA

Sixth International Conference on Mars

2003; ISSN 0161-5297; In English; Sixth International Conference on Mars, 20-25 Jul. 2003, Pasadena, CA, USA; See also 20030066531 - 20030066810, and 20030067624; Original contains color and black and white illustrations

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1164; Copyright; Avail: CASI; [C01](#), CD-ROM

This CD-ROM publication contains the extended abstracts that were accepted for presentation at the 6th International Conference on Mars, held in Pasadena, CA July 20-25, 2003. The CD-ROM contains the preface, table of contents, program, abstracts, and indexes. The extended abstracts review and debate some of the key questions and controversies that have matured during the flood of MGS and Odyssey data. The papers are presented in PDF format and are indexed by abstract author, and program author.

CASI

Conferences; Mars (Planet); Mars Surface; Mars Exploration

20030066531 Belgian Royal Observatory, Brussels, Belgium

Martian Global-scale Seasonal CO₂ Change: Comparison of Geodetic Observations and Numerical Simulations

Dehant, V.; deViron, O.; Karatekin, O.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Martian atmosphere exhibits an annual cycle in the CO₂ concentration; as much as 30% of the atmosphere takes part in seasonal exchange of mass between the atmosphere and the seasonal polar caps. The signature of this global-scale annual cycle can be found in the variation of gravitational field. This information can be used to estimate the global scale seasonal mass and atmospheric pressure variations. With recent Mars Global Surveyor mission, global scale CO₂ change in polar caps has been estimated by several authors. Although similar geodetic data are used, the results vary due to the differences in the approximations made. In the present study, these approaches are discussed and the polar mass changes are estimated. The results are compared with the values given by two Martian Global Circulation Models (GCM) as well as observations.

Derived from text

Carbon Dioxide Concentration; Atmospheric Composition; Mars Atmosphere; Polar Caps

20030066532 University of Northern Arizona, Flagstaff, AZ, USA

Utilizing Diverse Data Sets in Martian Impact Crater Studies

Barlow, N. G.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The wealth of multispectral and topographic data acquired by the Mars Global Surveyor (MGS) and Mars Odyssey (MO) missions has greatly expanded our understanding of the characteristics of martian impact craters. We are supplementing the information previously derived from Viking image analysis with the higher resolution visible images of MGS's Mars Orbiter Camera (MOC) and MO's Thermal Emission Imaging System (THEMIS), the daynight infrared data from THEMIS, and the topographic information from MGS's Mars Orbiter Laser Altimeter (MOLA). Our current studies focus on three general areas of crater analysis: (1) the effect of secondary cratering on the absolute age estimates of martian terrain units, (2) development of a preservation classification system, and (3) continued studies of what impact crater characteristics can tell us about the role of target properties (particularly subsurface volatiles) in crater formation.

Author

Mars Craters; Cratering; Geochronology; Mars Photographs; Planetary Geology; Mars Surface

20030066533 NASA Ames Research Center, Moffett Field, CA, USA

Constraints on Martian Surface Material from a Study of Volcanic Alteration in Iceland and Hawaii

Bishop, J. L.; Schiffman, P.; Southard, R. J.; Drief, A.; Verosub, K. L.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Subaerial volcanic activity on Hawaii and subglacial volcanic activity on Iceland has led to the formation of a variety of silicate and iron oxiderich alteration products that may serve as models for chemical alteration on Mars. Multiple samples have been collected from palagonitic tuffs, altered pillow lavas, altered tephra, and S-rich vents for study in the lab. Variations in the kinds of alteration products have been observed depending on the alteration environment of the sample. We are working on building associations between the alteration products and formation conditions that can be used to provide information about environmental conditions on Mars.

Author

Iceland; Mars Environment; Mars Surface; Mars Volcanoes; Mineralogy; Hawaii; Volcanoes

20030066534 California Inst. of Tech., Pasadena, CA, USA

Implications of Flow and Brittle Fracture of Ice Masses in South Polar Craters

Byrne, S.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Martian layered deposits have long been thought to be mostly water ice with varying admixtures of dust leading to the differing albedos and mechanical strengths of the layers. They have previously been mapped as a distinct unit based on their banded visual appearance. Topography data from the Mars Orbiter Laser Altimeter (MOLA) have confirmed these deposits to be several kilometers thick and broadly dome shaped, similar in many respects to the Greenland ice sheet on Earth.

The degree to which the present layered deposits behave like terrestrial ice sheets is unknown. The possibility of flow has been discussed by several authors; conversely brittle fracture and sublimation have been proposed to dominate over flow by others. In this work a series of features at the edge of the southern layered deposits are examined for evidence both for and against flow.

Derived from text

Planetary Geology; Mars Surface; Planetary Composition; Ice; Topography

20030066535 NASA Johnson Space Center, Houston, TX, USA

From Global Reconnaissance to Sample Return: A Proposal for a Post-2009 Strategy to Follow the Water on Mars

Clifford, S. M.; George, J. A.; Stoker, C. R.; Briggs, G.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Since the mid-1990's, the stated strategy of the Mars Exploration Program has been to Follow the Water. Although this strategy has been widely publicized, its degree of influence -- and the logic behind its current implementation (as reflected in mission planning, platform and instrument selection, and allocation of spacecraft resources) remains unclear. In response to this concern, we propose an integrated strategy for the post-2009 exploration of Mars that identifies the scientific objectives, rationale, sequence of missions, and specific investigations, that we believe provides the maximum possible science return by pursuing the most direct, cost-effective, and technically capable approach to following the water. This strategy is based on the orbital identification, high-resolution surface investigation, and ultimate sampling of the highest priority targets: near-surface liquid water and massive ground ice (potentially associated with the discharge of the outflow channels or the relic of a former ocean). The analysis of such samples, in conjunction with the data acquired by the necessary precursor investigations (to identify the locations and characterize the environments of the optimum sampling sites), is expected to address a majority of the goals and high priority science objectives identified by MEPAG.

Derived from text

Mars Exploration; Mars Surface; Mars Sample Return Missions; Exobiology; Surface Water

20030066536 Atmospheric Environmental Research, Lexington, MA, USA

A Novel Approach to Modeling Emissivity and Albedo of the Martian Seasonal Caps

Eluszkiewicz, J.; Titus, T. N.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Initial results from a new model for the emissivity and reflectivity of the martian seasonal caps represented as porous slabs are described. The radiative transfer modeling is linked to a physically based model of CO₂ frost metamorphism. Besides Mars, this coupled radiative transfer/sintering model is applicable to other Solar System bodies where slab-like volatile deposits are likely to be present, including Triton, Pluto, and Io.

Author

Mars Environment; Emissivity; Radiative Transfer; Albedo

20030066537 Los Alamos National Lab., NM, USA

The Global Distribution of Near-Surface Hydrogen on Mars

Feldman, W. C.; Prettyman, T. H.; Boynton, W. V.; Squyres, S. W.; Bish, D. L.; Elphic, R. C.; Funsten, H. O.; Lawrence, D. J.; Maurice, S.; Moore, K. R., et al.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Prime objectives of the neutron spectrometer (NS) component of the Gamma-Ray Spectrometer suite of instruments aboard Mars Odyssey are to identify the major reservoirs of hydrogen on Mars, determine their relative contributions to its total water inventory, and estimate the portion of the current inventory that is near the surface. Although more information is required than is currently available, epithermal neutron currents alone can provide a significant lower bound of hydrogen abundances on Mars. Observations from Viking 1, Viking 2, and Mars Pathfinder positively identified two of these reservoirs. By far the largest near-surface reservoir is comprised of the two residual polar caps, which together are sufficient to cover Mars with a global ocean about 30 m deep. The second is contained in the atmosphere, which if deposited on the surface, would cover Mars with a thin film of water about 10 - 5 m deep. Although negligible in comparison, the fact that an atmospheric

reservoir exists shows that it can provide a conduit that couples transient reservoirs of near-surface water ice.

Derived from text

Hydrogen; Ice; Mars Surface; Mars

20030066538 Centre National de la Recherche Scientifique, Paris, France

Scenarios to Explain the Formation of Gullies on Mars: Numerical Simulation with a Climate Model

Forget, F.; Mangold, N.; Costard, F.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The observations of geologically young gullies in the middle and high latitude on Mars are among the most debated topics in Martian science. Most scientists believe that their formation involved liquid water, but current temperature and pressure conditions on Mars are too low to allow liquid water or debris mixed with liquid water to freely flow on the surface.

Derived from text

Climate Models; Numerical Analysis; Mars (Planet)

20030066539 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Water Ice Clouds in the Martian Atmosphere: A Comparison of Two Methods and Eras

Hale, A. S.; Tamppari, L. K.; Christensen, P. R.; Smith, M. D.; Bass, Deborah; Pearl, J. C.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Similar cloud features are seen in maps generated with each method with no obvious outliers. The temperature differencing method appears to possibly be somewhat more sensitive to weaker water ice signatures. We have also generated correlation plots comparing the two methods. At strong delta-T signals, the correlation between the two methods is quite good, and therefore extraction of opacities from earlier Viking data may be possible for these stronger detection levels. Weaker detections do not, however, show such a good correlation. We are currently analyzing why the correlation becomes poor at weak signal levels, though it may be due to the fact that the differencing method may be more sensitive to thin cloud hazes. Results of this ongoing analysis will be presented. A comparison of the Viking and Mars Global Surveyor (MGS) eras are also presented.

Derived from text

Ice Clouds; Mars Global Surveyor; Viking Mars Program; Mars Atmosphere; Water; Methodology

20030066541 Scripps Institution of Oceanography, La Jolla, CA, USA

The Tharsis Region of Mars: New Insights from Magnetic Field Observations

Johnson, C. L.; Phillips, R. J.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Tharsis volcanic province dominates the western hemisphere of Mars. The regional topography comprises a long-wavelength rise of several kilometers elevation. Superposed on this are the Tharsis Montes, Olympus Mons and Alba Patera. To the southeast, the Tharsis rise includes Solis, Syria and Sinai Planae, bounded by Valles Marineris, Claritas Fossae, and the Coprates rise. The region also dominates the gravity field of the western hemisphere, with typical free air anomalies of several hundred milligals, and a peak free air anomaly greater than 1000 milligals over Olympus Mons.

Derived from text

Magnetic Fields; Mars Surface; Mars Volcanoes

20030066542 Arkansas Univ., Fayetteville, AR, USA

Methane Production by Methanogens in the Andromeda Environmental Chamber Under Conditions Approaching Those of the Martian Environment

Kral, T. A.; Sears, D. W. G.; Benoit, P. H.; Kareev, M. S.; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Surface conditions on Mars are probably too hostile for life, as we know it, to exist. Below the surface, however, is another matter. If subsurface liquid water is present, then conditions may be conducive to the growth of methanogens. Methanogens,

members of the domain Archaea, are microorganisms that are found deep below the surface of the Earth as well as deep within the oceans.

Derived from text

Methane; Methanation; Test Chambers; Mars Environment

20030066543 Arizona Univ., Tucson, AZ, USA

Cerberus Plains Volcanism: Constraints on Temporal Emplacement of the Youngest Flood Lavas on Mars

Lanagan, P. D.; McEwen, A. S.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Cerberus Plains (CP) are located on the southeastern margin of the Elysium Rise and extend for over 3000-km from east to west and approx. 600-km from north-to-south. The plains are bounded to the northwest by the Athabasca Valles outflow channel and ridged Elysium lavas, to the north by cratered, knobby terrains, and to the south by the Medusae Fossae Formation and ridged plains. The Marte Valles outflow channel joins the eastern Cerberus Plains with the lower-elevation western Amazonis Planitia. A system of WNW-ESE trending fissures of the Cerberus Fossae cut across the Cerberus Plains, the northern knobby terrains, and portions of the ridged Elysium lavas. Since the Cerberus Plains exhibit smooth surfaces. We examine the spatial and stratigraphic relationships between Cerberus Plains volcanic units and surrounding units and derive constraints for volumes of volcanic materials extruded and the duration of volcanic activity within the Cerberus Plains.

Derived from text

Topography; Volcanoes; Planetary Geology; Mars Surface; Lava

20030066547 Colorado School of Mines, Golden, CO, USA

Subsurface Exploration for Water on Mars

Olhoeft, G. R.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

This paper presents a discussion on the geophysical measurements used to explore the presence of water on Mars. Seismic and electromagnetic waves at the subsurface of Mars are examined

CASI

Electromagnetic Radiation; Geophysics; Seismic Waves; Mars Surface

20030066548 Lyon-1 Univ., Villeurbanne, France

Valles Marineris Landslides: Morphologies, Ages and Dynamics

Quantin, C.; Allemand, P.; Delacourt, C.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Valles Marineris (V.M) is affected by about 50 landslides. From Viking orbiters images, they were initially interpreted as large debris flows occurring during a unique activity period in the early history of Valles Marineris. In contrast to this interpretation involving water intervention, a second study has found analogies between Valles Marineris landslides and dry terrestrial rock avalanches. The role of fluids in the martian landslide dynamic is not unanimously admitted yet. A systematic analysis of geometry, morphology and chronology of the landslides is the key parameter to precise their dynamic. We then present results of a multidisciplinary study of Valles Marineris landslides using images with different spatial resolutions (Viking, MOC and THEMIS), Altimetric Data (MOLA) and dating methods.

Derived from text

Morphology; Mars Surface; Mars Photographs

20030066549 Michigan Univ., Ann Arbor, MI, USA

Electrical Discharges in the Martian Dust Devils and Dust Storms

Renno, N. O.; Wong, A. S.; Atreya, S. K.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The observations summarized in this article show a strong correlation between anomalously high martian microwave brightness temperature and the occurrence of dust devils and/or dust storms. We suggest that the observed anomalies are caused by impulsive discharges between dust particles, triboelectrically charged during dust events. The understanding of

electrical activity associated with dust events might have important implications for the chemistry of the martian atmosphere and the safe operation of Mars landers and rovers.

Author

Dust Storms; Mars Surface; Electric Discharges; Anomalies; Planetary Geology; Radio Observation

20030066550 NASA Ames Research Center, Moffett Field, CA, USA

Ophiolites as Analogs to Habitats on Mars

Schulte, M.; Blake, D. F.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Ophiolite sequences that are located in northern and central California provide easily accessible areas that serve as good analogs for martian crustal rocks. The rock types found in a typical ophiolite sequence compare well with those found in the Mars meteorites, and those expected from spectrophotometric analysis. We have begun investigating and characterizing these sites in order to understand better the processes that may be responsible for the groundwater chemistry, mineralogy and biology of similar environments on Mars.

Derived from text

Crusts; Rocks; Planetary Geology; Habitats; Mars Surface

20030066553 Johns Hopkins Univ., Laurel, MD, USA

Automated Analysis of Mars Multispectral Observations

Wagstaff, K.; Bell, J. F., III; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

In this abstract, we describe the result of applying an automated clustering algorithm to two data sets composed of Mars observations. One data set was collected by STIS on the Hubble Space Telescope; the other was obtained by the Mars Pathfinder Lander. We find that the results are comprehensible and, when a manual analysis is available for comparison, there is a good amount of agreement between the two sets of results. The automated analysis, however, requires significantly less time to produce results.

Derived from text

Algorithms; Automatic Control; Multispectral Photography; Mars (Planet); Observation; Cluster Analysis

20030066555 NASA Johnson Space Center, Houston, TX, USA

Life in the Ice

Allen, C. C.; Wainwright, N. R.; Grasby, S. E.; Harvey, R. P.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The current Martian surface environment is extremely hostile to any known form of life. The combination of subfreezing temperature, low atmospheric pressure and high ultraviolet flux, combined with desiccated and possibly oxidizing soil, could destroy even the hardiest microorganisms. The Viking biology experiments are generally interpreted to indicate that the surface of Mars is currently devoid of life and organic molecules at the part-per-billion level. Speculation on the possibility of extant or preserved microbial life on Mars thus centers on refuges in some manner protected from the current surface environment, either in space or time. Terrestrial analogs include hydrothermal systems, lakes, caves and subsurface aquifers as well as more clement conditions in the distant past. We are examining the evidence for microbiology in Earth's glaciated polar regions as analogs to the polar caps of Mars. This research concerns the detection of microorganisms or their preserved remains at the surface and within polar glacial ice.

Derived from text

Microorganisms; Polar Regions; Hydrothermal Systems; Analogs; Mars Environment; Ice Environments

20030066556 Washington Univ., Saint Louis, MO, USA

Science Rationale Associated with the Mars Exploration Rover Meridiani Planum Landing Site

Arvidson, Raymond E.; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Meridiani Planum Mars Exploration Rover landing site is located on smooth plains that expose the top stratum of

a widespread layered complex that overlies Noachian cratered terrain. This top unit is interpreted from MGS TES spectra to exhibit up to 15% by area of gray crystalline hematite, mixed with basaltic materials. Further, the unit exhibits dark, featureless plains, dark dunes, and inter-dune areas that expose bright underlying strata. Several hypotheses have been developed for emplacement and/or modification of the deposits and the widespread occurrence of hematite. The hypotheses include deposition in a large lake basin in oxygenated waters, accumulation and subsequent hydrothermal alteration of volcaniclastic deposits, and anhydrous oxidation of magnetite during emplacement as volcanic flows. The rover, with its Athena Payload, will be able to characterize the dark and bright materials exposed within a few hundred meters of the landing site, including use of Pancam and Mini-TES to determine the morphology and mineralogy of the units, and deployment of the Microscopic Imager, Moessbauer and Alpha Particle X-Ray Spectrometers onto key targets for in-situ observations. Particular attention will be given to delineating morphologic, textural, and mineralogical evidence to test among and update the hypotheses for the origin and evolution of the deposits, particularly the role of water in formation of hematite.

Author

Mars Exploration; Roving Vehicles; Landing Sites; Mars Surface

20030066557 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Mars Exploration Rovers as Virtual Instruments for Determination of Terrain Roughness and Physical Properties

Arvidson, R. E.; Lindemann, R.; Matijevic, J.; Richter, L.; Sullivan, R.; Haldemann, A.; Anderson, R.; Snider, N.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The two 2003 Mars Exploration Rovers (MERs), in combination with the Athena Payload, will be used as virtual instrument systems to infer terrain properties during traverses, in addition to using the rover wheels to excavate trenches, exposing subsurface materials for remote and in-situ observations. The MERs are being modeled using finite element-based rover system transfer functions that utilize the distribution of masses associated with the vehicle, together with suspension and wheel dynamics, to infer surface roughness and mechanical properties from traverse time series data containing vehicle yaw, pitch, roll, encoder counts, and motor currents. These analyses will be supplemented with imaging and other Athena Payload measurements. The approach is being validated using Sojourner data, the FIDO rover, and experiments with MER testbed vehicles. In addition to conducting traverse science and associated analyses, trenches will be excavated by the MERs to depths of approximately 10-20 cm by locking all but one of the front wheels and rotating that wheel backwards so that the excavated material is piled up on the side of the trench away from the vehicle. Soil cohesion and angle of internal friction will be determined from the trench telemetry data. Emission spectroscopy and in-situ observations will be made using the Athena payload before and after imaging. Trenching and observational protocols have been developed using Sojourner results; data from the FIDO rover, including trenches dug into sand, mud cracks, and weakly indurated bedrock; and experiments with MER testbed rovers. Particular attention will be focused on Mini-TES measurements designed to determine the abundance and state of subsurface water (e.g. hydrated, in zeolites, residual pore ice?) predicted to be present from Odyssey GRS/NS/HEND data.

Author

Mars Roving Vehicles; Terrain Analysis; Surface Roughness; Mars Surface; Terrain

20030066558 Observatoire de Midi-Pyrenees, Toulouse, France

Ground Ice and Impacts on Mars: New Constraints from Present and Future Missions

Baratoux, D.; Mangold, N.; Costard, Francois; Daydou, Yves; Decriem, Judicael; Pinet, P.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Impact cratering on Mars is significantly affected by the presence of subsurface volatiles. Martian rampart craters, characterized by the fluidized morphologies are thought to form by impact into ice-rich targets. However, the observed morphologies could have been produced by the impact-generated winds and vortices as well as, especially if the Martian atmosphere was denser in the past. The approach based on morphologic studies from images and topography fails to discriminate between these two mechanisms. Few attempts have been made to derive rheologic parameters of flowing ejecta. However, further modeling is needed in order to derive the water concentration in ejecta at the time of impact. We present here an inventory of the available data (morphology, topography, roughness, composition) and their physical meaning in order to constrain future models of the formation of these features.

Author

Mars Surface; Mars Craters; Ice; Cratering

20030066559 Massachusetts Univ., Amherst, MA, USA

Utopia Planitia: Observations and Models Favoring Thick Water-deposited Sediments

Buczowski, Debra L.; McGill, George E.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

One of the most important issues of martian geological history is whether or not there have been bodies of standing water on the surface at one or more times in the past. Because of its size and the volume of water involved, the most important of these putative bodies of water is the 'ocean' inferred to have occupied the northern lowland at various times during martian history. Assessing the validity of hypotheses for a northern paleocean involves determining the nature and thickness of the deposits that overlie the ancient Noachian floor of the northern lowland. Data from Mars Global Surveyor and Mars Odyssey can address the thickness and origin of these deposits in several ways, including evaluating proposed shorelines, comparing depositional ages with times of outflow channel activity, modeling behavior of the deposited materials, mapping associations between potentially diagnostic structures and lowland topography, and inferring deposit thickness from properties of these structures.

Derived from text

Planetary Geology; Mars Surface; Extraterrestrial Oceans; Planetary Composition; Sediments; Geomorphology

20030066560 Space Science Inst., Bald Head Island, NC, USA

Vertical Distributions of Dust Optical Depth During the 2001 Planet Encircling Storm from a Spherical Radiative Transfer Analysis of MOC Limb Images

Clancy, R. T.; Wolff, M. J.; Whitney, B. A.; Cantor, B. A.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Mariner 9 IRIS thermal profile analysis of Conrath and Viking limb analysis of Jaquin et al. form the basis for our current understanding of dust vertical profiles during major (planet-encircling) Mars dust storms. The June-Sept 2001 major dust storm provides the opportunity for a much more comprehensive study, based upon MGS MOC (Mars Orbital Camera) limb imaging and TES (Thermal Emission Spectrometer limb scan observations of dust vertical profiles in a globally extended dust storm. The current analysis pertains to MOC blue wide angle (WA) images returned in late July during the peak phase of the 2001 dust storm ($L_s=200-205$), and in September during the early clearing phase of the storm ($L_{(sub s)}=236$). A broader study under development will incorporate coarser vertical resolution TES limb observations (15 km versus the 2 km MOC resolution) with thermal IR (7-45 m) and solar band ($\lambda_{(sub eff)} = 0.7$ m) spectral coverage. This will eventually allow us to derive specific information on the vertical distribution of aerosol particle sizes. Here, we limit analysis to the retrieval of dust optical depth versus altitude for the purpose of defining the vertical extension of dust lifting during a planet-encircling dust storm.

Derived from text

Dust Storms; Imaging Techniques; Mariner 9 Space Probe; Optical Thickness; Radiative Transfer; Vertical Distribution; Cameras; Mathematical Models

20030066561 Universidad Rey Juan Carlos, Madrid, Spain

MOLA Topographic Data Analysis of the Atlantis Paleolake Basin, Sirenum Terrae, Mars

dePablo, M. A.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

In the region of Sirenum Terrae, at the Southeast of the martian Tharsis region, and at the South of Ma'adim Vallis there is a region in the one which are found several chaotic terrains as Gorgonum or Atlantis. In the basin where is found Gorgonum Chaos, the first images of the MOC sensor, aboard of the Mars Global Surveyor mission, showed the numerous gullies presence in the slopes of impact craters, fractures or chaotic terrains. These gullies were interpreted as the result of the groundwater presence in this basin. Afterwards it was described, employing the high resolution Viking images, one other depressed region, at the East of the previously mentioned basin, in the one which is found the Atlantis Chaos, as a possible paleolake basin. Thereinafter, and employing Viking images and MOLA/MGS topographic data it was described in the region of Sirenum Terrae, mainly between the Eridania y Phaethontis martian quadrants, a series of mutually communicated basins that they could operate as a great lake. Both basins, Gorgonum and Atlantis, are included within this great lake. In that work also were described as these lakes constituted the source area of the water that configured the Ma'adim Vallis channel, whose estuary is one of the possible landing points of the future robotic missions to Mars. Continuing with these previous studies,

here is presented a local analysis of the topographic characteristics of one of these paleolake basins: Atlantis, the one which de Pablo & Druet (2002) informally designated like Atlantis Basin because these basin contains in its interior to Atlantis Chaos, and whose criterion it will be continued employing here.

Author

Mars Surface; Structural Basins; Topography; Planetary Geology; Extraterrestrial Oceans

20030066562 Goettingen Univ., Germany

CO₂ Hydrate Formation Kinetics at Martian Conditions

Genov, G.; Kuhs, W. F.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations

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In the early seventies, the possible existence of CO₂ hydrates on Mars was proposed. Recent investigations show that clathrates could exist in a large volume of the Martian regolith at all latitudes, for all the present mean annual surface temperatures. Unfortunately, there is limited information about their physical properties and the physical chemistry of the formation and decomposition kinetics at Martian conditions. This paper comes to shed more light on those processes, presenting our results from the experiments on formation kinetics and micro-structural observations.

Derived from text

Carbon Dioxide; Hydrates; Kinetics; Mars Atmosphere; Physical Chemistry

20030066563 Aarhus Univ., Denmark

Magnetic Anomalies in Iceland: Implications for the Magnetic Anomalies on Mars

Gunnlaugsson, H. P.; Bendtsen, L. S.; Bertelsen, P.; Binau, C. S.; Gaarsmand, J.; Goetz, W.; Helgason, O.; Kristjansson, L.; Knudsen, J. M.; Leer, K., et al.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

This paper presents a study of the Stordalur, Kjalarnes and Bolungarvik magnetic anomalies in Iceland. The carrier of the remanence magnetization is in all cases Fe-Ti oxide phases. Only 2 wt% of the magnetic material is needed to explain the magnetic properties of the Martian crust.

Derived from text

Iceland; Magnetic Anomalies; Mars Surface; Planetary Geology; Sedimentary Rocks

20030066564 Hawaii Univ., Honolulu, HI, USA

Constraints on the Composition and Particle Size of High Albedo Regions on Mars

Hamilton, V. E.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The objective of this study is to place constraints on the composition and effective mean particle size of fine particulate mineralogies on the Martian surface. This objective is met via comparisons between infrared spectra of Martian bright, dusty regions and a variety of igneous analogue materials at a range of particle size fractions.

Derived from text

Albedo; Mineralogy; Mars Surface; Planetary Geology; Particulates; Planetary Composition

20030066565 Washington Univ., Seattle, WA, USA

Infrared Optical Constants of Martian Dust Derived from Martian Spectra

Hansen, B.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

This sensitivity study implies that we need to apply some constraints on the opacity and size distribution to improve the usefulness of any average optical constants that are derived. The variation of the 9-micron band strength is somewhat physically constrained. Scaling it up and down results in non-proportional changes to the 20-micron bands to retain the match to the IRIS spectra. The measured 9-micron imaginary index for basalt, andesite, and basaltic glass is between 1.1 and 1.2, while montmorillonite and granite are in the range 1.7-2.1. It seems unlikely that a physically reasonable material can have

this value much greater than 2 or less than a few tenths (where the Snook et al. model is), with the most likely value near 1. Raising the 9-micron and 20-micron band strengths yields an increasing long-wavelength real index (n_{∞}) through the Kramers-Kronig integral.

Derived from text

Dust; Mars (Planet); Mars Surface; Opacity; Infrared Spectra

20030066566 Brown Univ., Providence, RI, USA

Cold-based Glaciers in the Western Dry Valleys of Antarctica: Terrestrial Landforms and Martian Analogs

Head, J. W.; Marchant, D. R.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Basal-ice and surface-ice temperatures are key parameters governing the style of glacial erosion and deposition. Temperate glaciers contain basal ice at the pressure-melting point (wet-based) and commonly exhibit extensive areas of surface melting. Such conditions foster basal plucking and abrasion, as well as deposition of thick matrix-supported drift sheets, moraines, and glacio-fluvial outwash. Polar glaciers include those in which the basal ice remains below the pressure-melting point (cold-based) and, in extreme cases like those in the western Dry Valleys region of Antarctica, lack surface melting zones. These conditions inhibit significant glacial erosion and deposition. An intermediate classification of subpolar glaciers includes those with wetbased interiors and cold-based margins. Results from field-based research in Antarctica show that ancient landscapes are preserved beneath cold-based glacier ice. These results, along with new insights from quantitative measurements of glacial abrasion [e.g., 1], have prompted us to re-evaluate some Martian landforms in terms of glacial processes. As background, we here summarize the formation of drop moraines, sublimation tills, and rock glacier deposits associated with cold-based glaciers in the Dry Valleys of Antarctica, and then outline the case for similar glacial landforms along the western flanks of the Tharsis Montes, specifically Arsia Mons.

Derived from text

Antarctic Regions; Glaciers; Mars Surface; Mars Volcanoes; Planetary Geology; Valleys; Landforms

20030066567 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Analysis of Atmospheric Mesoscale Models for Entry, Descent and Landing

Kass, D. M.; Schofield, J. T.; Michaels, T. I.; Rafkin, S. C. R.; Richardson, M. I.; Toigo, A. D.; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Each Mars Exploration Rover (MER) is sensitive to the martian winds encountered near the surface during the Entry, Descent and Landing (EDL) process. These winds are strongly influenced by local (mesoscale) conditions. In the absence of suitable wind observations, wind fields predicted by martian mesoscale atmospheric models have been analyzed to guide landing site selection. Two different models were used, the MRAMS model and the Mars MM5 model. In order to encompass both models and render their results useful to the EDL engineering team, a series of statistical techniques were applied to the model results. These analyses cover the high priority landing sites during the expected landing times (1200 to 1500 local time). The number of sites studied is limited by the computational and analysis cost of the mesoscale models.

Derived from text

Atmospheric Models; Mars Atmosphere; Mesoscale Phenomena; Mars Landing Sites; Statistical Analysis

20030066568 Catholic Univ. of America, Washington, DC, USA

Mars Photochemistry: Weak Points and Search for Solutions

Krasnopolsky, Vladimir A.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains black and white illustrations

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Photochemical modeling is a powerful tool to study the chemical composition of a planetary atmosphere. Using densities of just two or three species near the surface of a planet, photochemistry makes it possible to calculate vertical density profiles for a few dozen species and describe chemical and physical processes that determine these profiles.

Author

Mars Atmosphere; Photochemical Reactions; Atmospheric Chemistry

20030066569 Centre National de la Recherche Scientifique, Paris, France

A Three-Dimensional Photochemical-Transport Model of the Martian Atmosphere

Lefevre, F.; Lebonnois, S.; Forget, F.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

This paper presents preliminary results of the first three dimensional simulations of the Martian photochemistry. Up to now only one-dimensional models have generally been used to determine the vertical profiles of trace constituents in the Mars atmosphere. These models have been very useful to estimate the globally averaged distribution of chemical species as a function of height, and have emphasized the role of water vapor to explain the classical problem of the stability of the Martian CO₂ atmosphere one-dimensional models cannot represent the dramatic meridional variations of the distribution of trace species caused by the usually strong pole-to-pole gradient of atmospheric temperature and water vapor. The effects of the meridional transport of chemical species are also ignored, and a highly uncertain eddy diffusion coefficient is used to represent the vertical transport and mixing. The only two-dimensional simulations published by Moreau et al. provided a better description of the interaction between dynamics, radiation, and chemistry, although the model did not include a consistent representation of the water cycle nor a treatment of the dynamics near the surface where the topographical effects are important.

Derived from text

Three Dimensional Models; Photochemical Reactions; Atmospheric Models

20030066571 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne, Germany

The Planetary Underground Tool (PLUTO) Experiment on the Beagle 2 Mars Lander

Richter, L.; Gromov, V. V.; Kochan, H.; Kosacki, K.; Tokano, T.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The payload of the Beagle 2 Mars lander of ESA's Mars Express mission includes a regolith-penetrating, tethered 'Mole' intended for acquisition of several subsurface soil samples from depths between about 10 cm and approximately 1.5 m. These samples will then be analyzed by the Gas Analysis Package (GAP) instrument on the lander, primarily with regard to isotopic composition and organic molecules. In addition, a share of each sample can be deposited onto the lander structure to be investigated with instruments mounted on the lander's PAW instrument carrier, such as the Mossbauer and X-ray fluorescence spectrometers and the optical microscope. After giving a brief overview of the experiment design, this paper focuses on the various science objectives addressed by the Beagle 2 Mole system, also referred to as the PLanetary Underground TOol (PLUTO). Apart from its capability to make subsurface regolith samples available to lander-based experiments for the first time on a Mars landing mission, PLUTO will be capable of performing scientific measurements of its own which utilize the Mole's soil penetration process and its temporary residence within the regolith.

Derived from text

Mars Surface; Mars Roving Vehicles; Mars Landing; Payloads; Instrument Packages; Planetary Geology; Mars Surface Samples

20030066572 NASA Johnson Space Center, Houston, TX, USA

Palagonitic (Not Andesitic) Mars: Evidence from Thermal Emission and VNIR Spectra of Palagonitic Alteration Rinds on Basaltic Rock

Morris, R. V.; Graff, T. G.; Mertzman, S. A.; Lane, M. D.; Christensen, P. R.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Visible and near-IR (VNIR) spectra of both Martian bright and dark regions are characterized by a ferric absorption edge extending from approx. 400 to 750 nm, with bright regions having about twice the reflectivity at 750 nm as dark regions. Between 750 nm to beyond 2000 nm, bright and dark regions have nearly constant and slightly negative spectral slopes, respectively. Depending on location, bright regions have shallow reflectivity minima in the range 850-910 nm that are attributed to ferric oxides. Similarly, dark regions have shallow reflectivity minima near approx. 950 and 1700-2000 nm that are attributed to ferrous silicate minerals (pyroxene). Among terrestrial geologic materials, the best spectral analogues for Martian bright regions are certain palagonitic tephra from Mauna Kea Volcano (Hawaii). By definition, palagonite is a 'yellow or orange isotropic mineraloid formed by hydration and devitrification of basaltic glass'. The ferric pigment in palagonite is nanometer-sized ferric oxide particles (np-Ox) dispersed throughout the hydrated basaltic glass matrix. The

hydration state of the np-Ox particles is not known, but the best Martian spectral analogues contain allophane-like materials and not crystalline phyllosilicates.

Derived from text

Andesite; Mars (Planet); Thermal Emission; Visible Spectrum; Near Infrared Radiation; Emission Spectra; Mars Surface

20030066573 Hawaii Univ., Honolulu, HI, USA

New Observations of the Diversity of Eruption Styles Along the SW Rift Zone of Arsia Mons, Mars

Mouginis-Mark, P. J.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

A great diversity in the eruptive style of Arsia Mons volcano can be identified from THEMIS, MOC and MOLA data. Collectively, these data sets provide the first opportunity to study lava shields within the summit caldera, kilometer-scale pit craters on the upper flanks, and the entire length of lava flows from vent to distal flow lobes. As such, a more complete picture of the history of this volcano is emerging which has both similarities to the other Tharsis Ridge volcanoes (Pavonis and Ascræus Montes) and differences with Olympus Mons.

Author

Mars Volcanoes; Mars Surface; Lava

20030066574 Hawaii Univ., Honolulu, HI, USA

A Very Young, Large, Impact Crater on Mars

Mouginis-Mark, P. J.; Boyce, J. M.; Hamilton, V. E.; Anderson, F. S.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

We have used data from the THEMIS, MOC, and MOLA instruments to study a remarkably fresh impact crater ~29 km in diameter, located just west of the Olympus Mons aureole. This crater has a very well preserved secondary crater field, a high nighttime temperature, exhibits no superposed primary impact craters, and has large depth/diameter and rim volume/cavity volume ratios. With lava flows as the target rock and a very young age, this crater must be a good candidate source crater for some of the SNC meteorites, and should serve as an excellent endmember for geometric studies of impact craters on Mars. The fact that this young crater also shows ample evidence for ejecta fluidization in the recent past strongly supports the idea that volatiles still exist within the top kilometer of the near-equatorial region of Mars.

Derived from text

Cavities; Mars Craters; Mars Volcanoes

20030066576 GeoForschungsZentrum, Potsdam, Germany

Evidence for a Surging Ice-Sheet in Elysium Planitia, Mars

Nussbaumer, J.; Jaumann, R.; Hauber, E.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

High resolution Viking images (orbit 724A, 14m/pixel) show evidence for ancient glaciation in parts of southeastern Elysium Planitia. While previous authors have mapped the materials as thin lacustrine and fluvial deposits [1], we present evidence for erosional and depositional processes associated with glacial environments. The previous ice sheet formed hummocky groundmoraines, eskers, and possibly pingos.

Derived from text

Ice; Deposits; Glaciers; Mars Photographs; Mars Surface

20030066577 California Univ., Los Angeles, CA, USA

The Global Three Dimensional Distribution and Temperature of Near-Surface Martian Ground Ice: New Results from MGS TES

Paige, D. A.; Scherbenski, J. M.; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

We have discovered significant global-scale seasonal thermal anomalies in the MGS TES surface temperature observations that coincide spatially with the Odyssey GRS observations of enhanced near-surface hydrogen abundance. The TES thermal anomalies can be explained quantitatively by the widespread presence of cold, high thermal inertia material

within millimeters to centimeters of the surface that we interpret as evidence for ground ice that must extend to depths of many meters. The results provide significant insights into the properties and processes that govern the behavior of Martian water under current climatic conditions, the surface geology of the planet, as well as much higher resolution Martian ground ice maps than have been previously available.

Derived from text

Climate; Ice; Mars Surface; Planetary Surfaces; Surface Temperature; Thermal Emission

20030066578 Colorado Univ., Boulder, CO, USA

Crustal Fields in the Solar Wind: Implications for Atmospheric Escape

Brain, D. A.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The strength of the magnetization of crustal sources at Mars suggests: 1) that the crustal sources have been present for billions of years, most likely having been magnetized early in Martian history by a global dynamo field; and 2) that the sources produce observable modifications to the martian solar wind interaction [Acuña et al., 2001]. Each of these conclusions has implications for one of the most fundamental issues in Mars science the history of martian climate. Regardless of whether the early martian atmosphere was warm or wet, few investigators dispute the idea that the present day atmosphere is substantially smaller than it was in the past; much of Mars early atmosphere has been lost. A number of atmospheric loss processes have operated at Mars over its history, including loss from impacts, adsorption into the martian polar caps and subsurface, and loss to space. It is important to understand the relative importance of these processes at different epochs, as well as the quantity of atmosphere that was removed by each process. Today, Mars small gravity and lack of a global magnetic field to protect the atmosphere from the solar wind make loss to space more efficient than at Earth or Venus. Prior to the discovery of crustal sources by the Mars Global Surveyor (MGS) magnetometer (MAG), model calculations of present day loss rates assumed that the solar wind interacted directly with the martian upper atmosphere. Here we examine how the discovery of crustal sources should revise our thinking about atmospheric escape to space at Mars, both at present and over martian history.

Derived from text

Earth Crust; Magnetic Fields; Mars Atmosphere; Solar Wind; Mars Surface

20030066579 University of Central Florida, Orlando, FL, USA

Mars as the Parent Body for the CI Carbonaceous Chondrites: Confirmation of Early Mars Biology

Brandenburg, J. E.; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The CI are ancient (4.6Gyr) hydrated clays with olivine and pyroxene grains imbedded in them and no evidence of hypervelocity impacts or chondrules. Based on isotopic and other geochemical data the CI appear to share many features with MMs (Martian Meteorites) and have been considered as candidate Martian sediments. If they are Martian they represent portions of the Noachian surface environment, and being rich in organic matter, they suggest the Noachian was a living environment. If the CI's are Martian they would represent samples of the Southern Martian Highlands Noachian regolith due to their 4.6 Gyr age. Implications of a possible Martian origin of CIs will be discussed, most importantly the fact that if the CIs are Martian, then the surface of Noachian Mars was warm, wet, and rich in organic matter. Since these samples are Martian, are the same age as ALH84001, and are rich in organic matter, and microfossils are reported in them, it would appear that the discovery of Mars biology by McKay and company is completely supported. Such a discovery would mean that Mars was a living planet and began a path of planetary evolution in a very similar way to Earth. In particular the property of life to modify its own environments so as to make them more friendly to life would have begun operation on Mars as it did on Earth. Thus, no model of Mars geo-chemical evolution that does not consider biological factors such as photosynthesis and an oxygen atmosphere may be considered complete. In addition, the early development of life on Mars, as well as on Earth, raises immediately the possibility that life predated both planets and was seeded from preexisting spores in space. Thus Panspermia may become the best explanation for the origin of life on Earth and will mean that life is common elsewhere in the Cosmos.

Derived from text

Extraterrestrial Life; Geochemistry; Meteoritic Composition; Planetary Evolution; Planetary Geology; Mars (Planet); Carbonaceous Chondrites

20030066580 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Determination of Net Martian Polar Dust Flux from MGS-TES Observations

Blackmon, M. A.; Murphy, J. R.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530
Contract(s)/Grant(s): NAG5-11164; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Using atmospheric dust abundance and atmospheric temperature observation data from the Thermal Emission Spectrometer (TES) on board the Mars Global Surveyor (MGS), the net flux of dust into and out of the Martian polar regions will be examined. Mars polar regions possess layered terrain, believed to be comprised of a mixture of ice and dust, with the different layers possibly representing different past climate regimes. These changes in climate may reflect changes in the deposition of dust and volatiles through impacts, volcanism, changes in resources of ice and dust, and response to Milankovitch type cycles (changes in eccentricity of orbit, obliquity and precession of axis). Understanding how rapidly such layers can be generated is an important element to understanding Mars climate history. This study uses the observed vertical temperature data and dust content measurements from TES to analyze the sign (gain or loss) of dust at high latitudes.

Derived from text

Mars Global Surveyor; Polar Regions; Spectrometers; Thermal Emission; Volcanology; Lunar Dust

20030066581 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Buried Impact Basins and the Earliest History of Mars

Frey, H. V.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The 'Quasi-Circular Depressions' (QCDs) seen in MOLA data which have little or no visible appearance in image data have been interpreted as buried impact basins on Mars. These have important implications for the age of the lowland crust, what mechanisms could produce the crustal dichotomy, and the existence of crust older than the oldest observed surface units on Mars. A global survey of large QCDs using high resolution MOLA data now available has provided further details of the earliest history of Mars. The lowlands are of Early Noachian age, slightly younger than the buried highlands and definitely older than the exposed highland surface. A depopulation of large visible basins at diameters 800 to 1300 km suggests some global scale event early in martian history, maybe related to the formation of the lowlands and/or the development of Tharsis. A suggested early disappearance of the global magnetic field can be placed within a temporal sequence of formation of the very largest impact basins.

Derived from text

Crusts; Highlands; Mars Surface; Structural Basins

20030066582 State Univ. of New York, Stony Brook, NY, USA

Low-Temperature Aqueous Alteration on Mars: Insights from the Laboratory

Tosca, N. J.; McLennan, S. M.; Lindsley, D. H.; Schoonen, M. A. A.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The soil-like material mantling the Martian surface is geologically and chemically complex and holds information of past and present climatic conditions on Mars. Present knowledge of this surface material suggests that low-temperature, aqueous alteration may have been a major factor in forming the material that has been sampled thus far by the Viking and Pathfinder landers. The term aqueous alteration used here, encompasses a wide range of processes and includes both dynamic and stagnant water-rock and gas-rock alteration mechanisms. Much effort has gone into characterizing this material, and several models, based on a wide range of evidence, have given rise to many processes and resultant mineral/mineraloid phases that may be (or have been) of importance on the surface of Mars.

Derived from text

Low Temperature; Mars Environment; Soils; Climate

20030066584 National Air and Space Museum, Washington, DC, USA

Measurements of Dune Heights on Mars

Williams, K. K.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Dunes on Mars were first detected during the Mariner 9 mission. The dunes demonstrated that the martian atmosphere must have possessed the combination of wind velocity and atmospheric density necessary to construct dunes in the past Mars climate. Although no evidence of dune change has yet been found, the question of whether or not the present wind regime can move sand-sized material remains unanswered. The characteristics of dunes do, however, provide information about the history of sediment transport on Mars.

Derived from text

Dunes; Height; Sands; Mars Surface

20030066585 National Air and Space Museum, Washington, DC, USA

Decameter-scale Ripple-like Features in Nirgal Vallis as Revealed in THEMIS and MOC Imaging Data

Zimbelman, J. R.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Mars Orbiter Camera (MOC) images quickly revealed the nearly ubiquitous occurrence of decameter-scale ripple-like features. These features have been interpreted as either small dunes or large ripples. THEMIS images now provide a new way to examine these distinctive features, in conjunction with both MOC images and field results from large terrestrial aeolian ripples. A portion of the central section of Nirgal Vallis is used here as a site to study these ripple-like features at several scales.

Derived from text

Mars Volcanoes; Imaging Techniques; Data Processing; Mars Surface; Planetary Geology; Decametric Waves

20030066586 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

The Mars Reconnaissance Orbiter (MRO) Mission

Zurek, Richard W.; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

In August 2005, NASA's Mars Exploration Program (MEP) will launch the Mars Reconnaissance Orbiter (MRO) to Mars. Carrying a suite of six science instruments, UHF radio relay, and two technology demonstration packages, the MRO Mission pursues the NASA MEP Follow the Water strategy through a series of remote sensing observations. These are designed to characterize the current Mars climate, including the thermal structure and circulation of its atmosphere, the stratigraphy and composition of its surface, and the three-dimensional structure of the uppermost ground layer. In addition, the MRO will provide globally distributed data to be used to identify and characterize future landing sites that have a high potential for further scientific discovery.

Author

Mars Exploration; Remote Sensing; Mars Missions; Climate; Reconnaissance

20030066587 Hawaii Univ., Honolulu, HI, USA

Mineralogy of the Valles Marineris from TES and THEMIS

Anderson, F. S.; Hamilton, V. E.; Christensen, P. R.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

This study uses Mars Global Surveyor Thermal Emission Spectrometer (TES) and 2001 Mars Odyssey Thermal Emission Imaging System (THEMIS) data to examine the mineralogy of the wall and floor deposits of the Valles Marineris (VM), where exposed. We present results from TES analysis of the VM region as well as detailed analysis of Melas Chasma, and note a remarkable degree of correlation between high-resolution THEMIS thermal images and full resolution TES data. Using THEMIS as a mapping tool, we will correlate the observed TES and THEMIS spectra, identifying unique local compositional signatures, complementing previous studies that averaged data at a regional scale. The observed composition and stratigraphic relationships determined from the Mars Orbiting Laser Altimeter (MOLA) can then be used to constrain the processes acting on the walls and floors of the VM.

Derived from text

Mineralogy; Mars Surface; Thermal Emission; Spectroscopic Analysis

20030066588 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Surface Roughness of Terrains on Mars

Deal, K. S.; Arvidson, R. E.; Neumann, G. A.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The RMS roughness measurements produced by Neumann et al. from Mars Orbiter Laser Altimeter (MOLA) data provide unique information about surface height variations at an effective length scale of < 75 m. Roughness at this scale is important not only for landing site safety considerations, but also for assessment of landscape evolution, which depends on emplacement mechanisms and erosional/depositional processes. Here we present an examination of the global surface roughness map with discussion of terrain types and potential formation and/or alteration mechanisms. Spatially coherent terrain types were identified based on inspection of the roughness map. These terrains were further characterized through analysis of morphology and geology using MOLA topography, MOC wide-angle, and MOC narrow-angle images as well as the geologic maps produced by Scott & Tanaka and Greeley & Guest. All of these data were used to explore potential formation and modification processes.

Author

Surface Roughness; Terrain; Mars Surface; Maps; Planetary Geology

20030066590 NASA Ames Research Center, Moffett Field, CA, USA

MRO's High Resolution Imaging Science Experiment (HiRISE): Education and Public Outreach Plans

Gulick, V.; McEwen, A.; Delamere, W. A.; Eliason, E.; Grant, J.; Hansen, C.; Herkenhoff, K.; Keszthelyi, L.; Kirk, R.; Mellon, M., et al.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The High Resolution Imaging Experiment, described by McEwen et al. and Delamere et al., will fly on the Mars 2005 Orbiter. In conjunction with the NASA Mars E/PO program, the HiRISE team plans an innovative and aggressive E/PO effort to complement the unique high-resolution capabilities of the camera. The team is organizing partnerships with existing educational outreach programs and museums and plans to develop its own educational materials. In addition to other traditional E/PO activities and a strong web presence, opportunities will be provided for the public to participate in image targeting and science analysis. The main aspects of our program are summarized.

Derived from text

NASA Programs; High Resolution; Education; Science; Imaging Techniques; Mars Exploration

20030066591 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Berlin, Germany

The Large Thaumasia Graben, Mars: Is It a Rift?

Hauber, E.; Kronberg, P.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

We describe the morphology of a large and complex extensional structure in the western Thaumasia region (the 'Thaumasia graben' [1] or TG). This is the first detailed description of this structure, taking into account reliable MOLA based topographic information. We consider possible fault geometries, determine extension, and discuss the case for or against a classification as a rift.

Derived from text

Geological Faults; Mars Surface; Morphology; Planetary Geology; Topography

20030066592 Southwest Research Inst., Boulder, CO, USA

The Effect of Convective Adjustment on the Global Circulation of Mars as Simulated by a General Circulation Model

Rafkin, S. C. R.; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Many Mars Global Circulation Models (MGCMs) use convective adjustment to simulate the process of subgrid-scale mixing in the convective boundary layer. Three important underlying assumptions for convective adjustment are: 1) that the atmosphere instantaneously removes potential energy contained within an unstable stratified atmosphere; 2) that there exists an equilibrium between the generation and consumption of potential energy; and 3) that the kinetic energy generated due to circulations that remove potential energy may be neglected. These three assumptions are generally reasonable for global circulation modeling of the terrestrial atmosphere, from which the Mars modelling community has its roots. However, there is observational, theoretical, and numerical modeling evidence that one or more of the assumptions underlying the convective adjustment process are grievously violated in Mars atmosphere.

Derived from text

Convection; Atmospheric General Circulation Models; Mars Atmosphere

20030066594 Arizona Univ., Tucson, AZ, USA

Secondary Cratering on Mars: Implications for Age Dating and Surface Properties

McEwen, A. S.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Are small (< 1 km diameter) craters on Mars dominated by primary impacts or by the secondary impacts of much larger primary craters? Many craters are obvious secondaries, closely associated with the primary crater and with distinctive morphologies such as irregular shapes and occurrence in chains and clusters with herringbone patterns. However, there has been a longstanding controversy about the relative abundances of small primaries versus distant secondaries on the Moon. Distant secondaries are expected to be more circular and isolated (except when concentrated in rays) than the obvious secondaries, difficult to distinguish from degraded (shallow) primaries. The answer to this question has implications for age constraints on young surfaces and implied climate change, the physical properties of impact-generated regolith, provenance of surface rocks accessible to surface exploration or sample return, engineering considerations (landing safety and rover trafficability), and the origin of Martian meteorites.

Derived from text

Mars Craters; Cratering; Mars Surface; Regolith; Impact Damage; Meteorite Craters; Surface Properties; Geomorphology

20030066595 California Inst. of Tech., CA, USA

Stratigraphic Implications of the Relaxation of Troughs and Scarps Within the Martian North Polar Layered Deposits

Pathare, A. V.; Paige, D. A.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Previously, we showed that the viscous relaxation of subsurface water ice in the North Polar Layered Deposits (NPLD) provides a much better fit than does surface sublimation to the key morphological observations of NPLD troughs and scarps. These include: the lack of latitudinal dependence of either the maximum surface slope or total depth of NPLD troughs; the correlation of maximum surface slope to total depth of NPLD scarps; the equatorward-facing/ poleward-facing (EWF/PWF) slope asymmetry of opposing NPLD trough walls; and the presence of extremely steep NPLD scarps well above the angle of repose. Here, we argue that the stratigraphy of North PLD troughs and scarps is also more consistent with relaxation .

Derived from text

Planetary Geology; Mars Surface; Stratigraphy; Polar Caps; Mars Atmosphere; Remote Sensing

20030066596 Arizona State Univ., Tempe, AZ, USA

Testing the Pseudocrater Hypothesis

Payne, M. C.; Farmer, J. D.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

In a regional study of the margin of the north polar cap, a field of coniform features was observed in the Olympia Planitia region and hypothesized to be a pseudocrater field. Volcano-ice features located at the margin of a polar cap has great significance for astrobiology. Such interactions could provide potential shallow subsurface habitable zones of liquid meltwater, as well as a mechanism for transporting a subsurface biota into near-surface environments via convecting hydrothermal systems. Such a biota, or prebiotic organic chemistry, could be subsequently cryopreserved in shallow polar ground ice formed as such systems cooled and died. In this study, a number of methods were employed to test the pseudocrater hypothesis, including feature profiling (using MOLA data), geomorphic measurements (e.g. crater diameter/ cone diameter ratios), nearest neighbor analysis, and comparisons to potential terrestrial analogs. Candidate analog terrestrial landforms studied included Icelandic pseudocraters, cinder cones, shield volcanoes, maar craters, pingos, and hummocky moraine. Comparisons were also made with martian rampart craters, and features previously interpreted as martian pseudocraters.

Derived from text

Planetary Cryospheres; Mars Surface; Mars Volcanoes; Polar Caps; Cratering; Surface Properties

20030066597 California Univ., Berkeley, CA, USA

Viscous Flow of Ice-rich Crater Fill Deposits and Periodic Formation of Protalus Ramparts: A Climate Record?

Perron, J. T.; Howard, A. D.; Dietrich, W. E.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Howard has argued that the arcuate ridges of debris at or near the base of pole-facing crater walls at intermediate southern latitudes on Mars are analogous to terrestrial protalus ramparts, and that they formed at the margins of volatile-rich deposits mantling the crater walls. The presence of multiple generations of relatively undeformed ramparts on crater floors suggests

the advection of a rigid surface layer over deep deposits that fill the crater and are undergoing ductile deformation. Comparison of the cross-sections of these craters with those of fresh craters indicates the presence of several hundred meters of deposits, and MOLA profiles show that the crater floors slope in the apparent flow direction. The observation that there is some regularity to the spacing of the ramparts suggests that they formed in response to quasi-periodic climate changes. We use measured crater floor slopes and spatial relationships of ramparts, inferred fill deposit thicknesses, and ice flow laws to estimate the elapsed time between rampart formation events.

Derived from text

Viscous Flow; Mars Surface; Cratering; Mars Craters; Planetary Geology; Mathematical Models; Ice

20030066598 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Mars Odyssey THEMIS-VIS: Surface-Atmosphere Separation and Derivation of Aerosol Properties

McConnochie, T. H.; Bell, J. F., III; Wolff, M. J.; Smith, M. D.; Bandfield, J. L.; Richardson, M. I.; Christensen, P. R.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Scattering by atmospheric aerosols can contribute a substantial fraction of the visible-light radiance observed in any remote sensing of Mars. Our objective is to develop techniques to separate this aerosol component from the surface-reflectance component in Mars Odyssey's THEMIS Visible Imaging Subsystem (THEMIS-VIS) dataset. The primary purpose of this study is the production of accurate surface reflectance data in order to allow for reliable color and mineralogical unit mapping. The second principal goal is to study the feasibility of using VIS measurements to derive quantitative information about ice and dust aerosol properties such as particle size and optical depth.

Derived from text

Mars (Planet); Remote Sensing; Atmospheric Scattering; Aerosols; Imaging Techniques; Mars Missions; Spectral Reflectance; Spacecraft Instruments

20030066599 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Observations of the Mars Polar Vortex

McConnochie, T. H.; Conrath, B. J.; Gierasch, P. J.; Banfield, D.; Smith, M. D.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The winter season, westerly circumpolar flow of the Martian atmosphere, and of the terrestrial stratosphere, is concentrated into a jet whose latitude falls between 60 and 80 degrees. This jet is known as the polar vortex. The terrestrial polar vortex has been understood to be the dynamical controlling mechanism for ozone depletion in the polar stratosphere for more than a decade. More recently, the earth's stratospheric annular modes, which are essentially a weakening/strengthening oscillation of the polar vortex jet, have been shown to be coupled to and possibly even a driving mechanism for, the tropospheric Arctic Oscillation (AO) / North Atlantic Oscillation (NAO) phenomenon.

Derived from text

Mars Atmosphere; Mars (Planet); Polar Caps; Planetary Cryospheres; Remote Sensing

20030066600 State Univ. of New York, Stony Brook, NY, USA

Composition and Chemical Evolution of the Martian Crust and Mantle: Integrating the Data from Missions and Meteorites

McLennan, Scott M.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Our understanding of the chemical composition and chemical evolution of the martian crust and mantle is now advancing rapidly. A critical challenge for the future will be the integration of the chemical and mineralogical data derived from: (1) Planetary-scale orbital missions that provide imaging, spectroscopic, geophysical and geochemical data on scales of meters to many kilometers (e.g., Global Surveyor, Mars Odyssey); (2) Localized landed missions that provide relatively good geological context but return limited varieties of geochemical data (Viking, Pathfinder and the imminent Beagle-2 and Mars Exploration Rovers); (3) Martian (SNC) meteorites that are comprehensively analyzed for petrology, geochemistry, and isotopes, but that have poorly understood geological context.

Author

Chemical Composition; Chemical Evolution; Planetary Crusts; Planetary Mantles; Planetary Geology; Mars Surface

20030066601 Washington Univ., Saint Louis, MO, USA

Noachian Evolution of Mars

Phillips, R. J.; Johnson, C. L.; Hynek, B. M.; Jakosky, B. M.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Noachian era on Mars is distinguished by the development of the Tharsis rise and the widespread creation of terrain types that likely required the involvement of running water. Here we review both aspects as well as possible interrelationships between Tharsis evolution and global geomorphic signals of fluvial activity. Origin and Evolution of Tharsis: Following the Derived from text

Geomorphology; Mars Surface; Planetary Geology; Water; Planetary Mantles

20030066602 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Fluvial and Lacustrine Processes in Meridiani Planum and the Origin of the Hematite by Aqueous Alteration

Newsom, H. E.; Barber, C. A.; Schelble, R. T.; Hare, T. M.; Feldman, W. C.; Sutherland, V.; Livingston, A.; Lewis, K.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy

The prime MER landing site in Meridiani Planum is located on layered materials, including hematite, whose origin as lacustrine or aeolian sediments, or volcanic materials is uncertain. Our detailed mapping of the region provides important constraints on the history of the region. Our mapping of the location of fluvial and lacustrine land forms in the region relative to the layered deposits provides new evidence of a long history of erosion and deposition as has long been noted. In addition, our detailed mapping of the southern boundary of the hematite deposit strongly supports an association between longlived fluvial channels and lacustrine basins and the strongest hematite signatures. This evidence supports an origin of the hematite deposits by interaction with water under ambient conditions in contrast to suggestions of hydrothermal processes due to volcanic or impact crater processes. An important part of the story is the evidence for the localization of the layered deposits due to topographic control induce by the presence of a large early basin we have identified that extends to the north-east of the landing site. Distribution of current channel networks, drainages,

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Mars Surface; Planetary Geology; Mars Volcanoes; Geomorphology; Remote Sensing; Mars Craters; Cratering

20030066603 NASA Johnson Space Center, Houston, TX, USA

MGS/TES-Odyssey/THEMIS-IR Analysis of Localized Low Albedo Regions in Valles Marineris

NoeDobrea, E. Z.; Bell, J. F., III; Wolff, M. J.; Snook, K. J.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

We are conducting a systematic analysis of small (approximately 10's of km), localized regions in Valles Marineris that display significant albedo differences relative to their surroundings. This analysis is based on a finding that the locations of the hematite deposits identified by [1] in the interior layered deposits of Valles Marineris typically coincide with regions having a low MGS/TES visible bolometric albedo [1,2]. Until recently, it was difficult to identify the morphology or geologic context of the regions containing the hematite deposits. However, with the recent advent of high-resolution (1/128 /pixel) MOLA grided topography and Mars Odyssey's THEMIS-IR instrument, it has been possible to better understand the morphologic context of TES observations. This analysis combines the use of PDS-released data from the MGS/TES visible bolometer and infrared spectrometer, the Odyssey/THEMIS Infrared imager, and MOLA grided topography. First, the TES infrared bolometer is used to identify regions of interesting albedo variability, and is overlaid on Viking controlled photomosaics for context. THEMIS-IR data, in conjunction with MOLA topography, is then used to: 1) identify the context and morphology of the area; and 2) identify spectrally unique regions at the km scale. In preparation for the latter, all the THEMIS planes are coregistered using an autocorrelation routine, the data are converted to brightness temperature and then each plane is normalized to the brightness temperature of the third plane (1261 cm⁻¹). We then perform a 3-band search for color variations and a Principle Components Analysis (PCA) of the 8 unique bands in the THEMIS-IR dataset. Any variability is then investigated using both THEMIS-IR and TES spectra of the same regions. In both cases, the spectra are ratioed to near-simultaneously acquired spectra of adjacent or 'average' regions that do not show this albedo variation, therefore allowing us to identify spectral variability unique to the area of interest. This procedure also allows us to account for calibration problems in THEMIS-IR data, and for any atmospheric effects in both the THEMIS-IR and the TES data.

Derived from text

Mars Surface; Planetary Mapping; Albedo; Geomorphology; Planetary Geology; Imaging Techniques; Remote Sensing

20030066606 Arizona State Univ., Tempe, AZ, USA

The Nature of the Martian Aqueous Environments Recorded by ALH84001 Carbonates

Niles, P. B.; Leshin, L. A.; Guan, Y.; Sixth International Conference on Mars; 2003, pp. 1-4; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Direct evidence for the existence of water on Mars consists of morphologic features, thermal spectroscopic signatures of hematite, detection of H₂O ice in the polar caps, neutron spectroscopy, and secondary minerals preserved in martian meteorites. The martian meteorites currently provide the best opportunity to assess the detailed nature of the aqueous environments that once existed on Mars, simply because of the high level of capability of Earth based analytical techniques. The martian meteorite ALH84001 has a 4.5 Ga crystallization age and it contains a unique assemblage of secondary carbonates that formed on Mars 3.9 Ga [1]. The meteorite is remarkably well preserved but has been extensively shocked. This provides an opportunity to learn specific environmental constraints of the nature of one or more aqueous systems on early Mars. The meteorite shows very little evidence for aqueous

Derived from text

Meteorites; Meteoritic Composition; Mars Surface; Water; Mars Environment; Planetary Geology

20030066611 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Martian Crustal Magnetism: What Have We Learned After Approximately 6 Years of MGS Observations?

Acuna, M. H.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The MAG/ER investigation aboard the Mars Global Surveyor (MGS) has established conclusively that an internal, dynamo-generated field does not currently exist at Mars and discovered, unexpectedly, strong magnetization in the crust. An estimate of the upper limit of the current Mars dipole moment derived from the MGS data yields $M < \sim 2 \times 10^{17}$ A-m², which corresponds to a surface equatorial field strength of < 0.5 nT. The intense magnetization of the crust is closely associated with the ancient, heavily cratered high terrain, which lies south of Mars dichotomy boundary. The correlation of magnetization with the old terrain and the role of impacts, which have modified the magnetic properties of the crust, constitute a new and powerful diagnostic tool that is providing a unique view into the early thermal history of the planet, which was almost totally unknown prior to the arrival of MGS. Data from the Lunar Prospector mission complement contemporary analyses and interpretation of crustal magnetism in planetary system bodies that do not currently possess core dynamos. The observation of magnetic lineations over Terra Sirenum (Sirenum Fossae) and Terra Cimmeria, are suggestive of tectonic processes observed at Earth in association with sea-floor spreading and geomagnetic field reversals. If this association is correct, it would indicate the possible existence of plate tectonics and magnetic field reversals in Mars' early history. Alternative models involving fault/graben formation associated with the fracturing of a thin, magnetized crustal layer by tectonic or volcanism-induced stresses, yield equally valid interpretations. To date, no reliable correlation between topography, geology and crustal magnetism has been established and the origin of these remarkable Martian magnetic anomalies remains a mystery.

Derived from text

Mars Global Surveyor; Magnetic Anomalies; Planetary Magnetic Fields; Planetary Crusts; Mars (Planet); Dynamo Theory

20030066612 Cologne Univ., Germany

Investigations of Martian Dust Devils

Stanzel, C.; Paetzold, M.; Neubauer, F. M.; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Dust devils are dust-raising vortices, which occur typically in the afternoon, when the ground has warmed up the overlying air and which now begins to ascend. Small sand particles can be taken up by this ascending air and make the vortices visible. This is a well known phenomenon on Earth. The analysis of the Viking Orbiter images taken from 1976 to 1980 showed a main occurrence of dust devils likewise in the afternoon in the summer of the northern hemisphere. It is assumed that dust devils are responsible for the entry of dust in the atmosphere and therefor represent an important aspect in the physics of the boundary layer of the martian atmosphere. Dust devils are recognized in Viking Orbiter images as bright clouds with long elongated shadows. Another characteristic is that dust devils are moving. A strict positive criterion for dust devil recognition during the investigation of Viking Orbiter images was the nonexistence of the characteristics on following or preceding images. Altogether over 250 dust devils were discovered, including dust devil candidates without second image. These phenomena are most frequent between 14.30 and 16 pm in local afternoon. The height is 1000 m on average and the

base diameters range from 200 to 300 m. The analysis of Viking and Mars Global Surveyor images will be continued by using pattern recognition techniques. This will be continued with the HRSC experiment on Mars Express starting in 2004 to receive further results regarding the temporal and spatial occurrence, the height, the motion and the direction of motion as well as the velocity and the dust entry into the atmosphere.

Derived from text

Dust; Mars Surface; Planetary Geology; Mars Atmosphere

20030066613 Lunar and Planetary Inst., Houston, TX, USA

Drainage Densities of Computationally Extracted Martian Drainage Basins

Stepinski, T. F.; Collier, M. L.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Drainage densities are calculated for five Martian drainage basins computationally extracted from the dissected Noachian surfaces. Mars Orbiter Laser Altimeter data is used to construct digital elevation models (DEMs) representing topography of selected Martian locations. Our computational method uses these DEMs to extract and reconstruct individual basins. Channel networks are delineated from their underlying basins using a channelization threshold based on the constant drop property for streams. Calculated drainage densities refer to individual basins and their values are in a relatively narrow range of 0.06-0.11 per kilometer, one to three orders of magnitude smaller than values of drainage density for terrestrial basins. We claim that the values of drainage density calculated using our method are more robust than values obtained using imagery data. We also calculate uniformity of drainage density and obtain values of in the range of 2.55-3.28, comparable to low-end terrestrial values. Finally, we calculate the slope area relations for these basin and find the value of concavity exponent to be in the range of 0.1-0.22, lower than typical terrestrial values. These findings are inconsistent with the notion of the origin of Martian valley networks by means of surface runoff due to sustained and widespread precipitation.

Author

Drainage; Mars (Planet); Mars Surface; Planetary Geology; Structural Basins

20030066614 California Inst. of Tech., Pasadena, CA, USA

Morphological and Thermo-Physical Properties of Slope Streaks

Aharonson, Oded; Schorghofer, Norbert; Richardson, Mark; Khatiwala, Samar; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Slope streaks are a class of features forming on the surface of present day Mars. They were discovered in high resolution Viking Orbiter images, but only Mars Orbiter Camera (MOC) images revealed that they are currently active. Sullivan et al. developed a kinematic model for dry dust avalanches that is consistent with observed characteristics of slope streaks. Schorghofer et al. correlated streak regions with surface properties including low thermal inertia, topographic roughness, and peak temperature in search for a triggering mechanism, and considered the potential role of trace amounts of water. Ferris et al. suggested that more voluminous aqueous processes are involved in streak formation. Here, we seek to improve upon previously described correlation with surface temperatures measured on kilometer scales by the Thermal Emission Spectrometer, by examining and modeling local surface temperatures measured on 100m scales by the Thermal Imaging Spectrometer.

Derived from text

Mars Surface; Slopes; Thermophysical Properties; Geomorphology; Thermal Analysis

20030066617 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Sample Analysis at Mars

Brinckerhoff, W. B.; Mahaffy, P. R.; Cabane, M.; Atreya, S. K.; Coll, P.; Cornish, T. J.; Harpold, D. N.; Israel, G.; Niemann, H. B.; Owen, T., et al.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The next landed missions to Mars, such as the planned Mars Science Laboratory and ExoMars, will require sample analysis capabilities refined well beyond what has been flown to date. A key science objective driving this requirement is the determination of the carbon inventory of Mars, and particularly the detection of organic compounds. While the gas chromatograph mass spectrometers (GC/MS) on the Viking landers did not detect any indigenous organics in near surface

finer, it is possible that these measurements were not representative of Mars on the whole. That is, those compounds to which the GC/MS was sensitive would likely not have survived the strong oxidative decomposition in the regolith at the landing sites in question. The near surface fines could very well contain a significant quantity of refractory compounds that would not have been volatilized in the sample ovens on Viking. It is also possible that volatile organics exist on Mars in sedimentary, subsurface, or polar niches.

Derived from text

Spacecraft Instruments; Mars Surface; Planetary Geology; Carbon; Organic Compounds; Mars Surface Samples; Samplers

20030066619 Tennessee Univ., Knoxville, TN, USA

Global Search for Evaporite Deposits in Putative Paleolake Basins on Mars Using TES Data

Stockstill, K. R.; Baldridge, A.; Ruff, S.; Moersch, J.; Farmer, J.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

This paper presents an intense examination of 45 putative paleolake basins to identify evidence of evaporate deposits utilizing Thermal Emission Spectrometer (TES) emissivity data at 3x6 kilometer per pixel resolution.

CASI

Mineral Deposits; Sedimentary Rocks; Mars Atmosphere; Mars Surface; Structural Basins; Thermal Emission; Spectra

20030066621 Los Alamos National Lab., NM, USA

Emissivity Spectrum of a Large 'Dark Streak' from THEMIS Infrared Imagery

Brumby, S. P.; Vaniman, D. T.; Bish, D.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Dark streaks, also known as slope streaks, are unusual surface features found on Mars that are known to appear and fade away on timescales of years. Various explanations have been proposed for their origin and composition, including dry avalanches and wet debris or precipitates from brines. Previous investigations have been based on analysis of panchromatic imagery and altimetry from Viking and Mars Global Surveyor missions. We have obtained an infrared emissivity spectrum of a large dark streak on the north western edge of Olympus Mons, using imagery from the THEMIS instrument on the Mars Odyssey 2001 spacecraft.

Derived from text

Infrared Spectra; Infrared Imagery; Emissivity; Mars Surface; Remote Sensing; Surface Properties

20030066622 NASA Ames Research Center, Moffett Field, CA, USA

The Mars Underground Mole (MUM): A Subsurface Penetration Device with In Situ Infrared Reflectance and Raman Spectroscopic Sensing Capability

Stoker, C. R.; Richter, L.; Smith, W. H.; Lemke, L. G.; Hammer, P.; Dalton, J. B.; Glass, B.; Zent, A.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color illustrations
Contract(s)/Grant(s): MIDP-896-30; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

This paper presents a detailed description of The Mars Underground Mole (MUM) instrument developed by the Mars Instrument Development Program (MIDP), that is used to study the subsurface of Mars.

CASI

Detection; Infrared Spectroscopy; Raman Spectroscopy; In Situ Measurement; Mars Missions; Mars Surface Samples; Reflectance

20030066623 Hawaii Univ., Honolulu, HI, USA

Maximum Rates of Olivine Dissolution on Mars

Stopar, J. D.; Taylor, G. J.; Hamilton, V. E.; Browning, L.; Pickett, D.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

This work is a first step in constraining olivine alteration rates on Mars. By bounding dissolution rates of olivine, we can make inferences about the temporal extent of aqueous alteration on the surface. Several hypothesized low-temperature surface aqueous alteration processes include valley network formation from release of groundwater during impact or gully formation

from snow melt, both of which may occur over a period of several thousand years. Outflow channels may have formed during brief floods lasting less than a year. If large bodies of water were present during a warm, wet period, large standing bodies of water may have been present for 104 to 109 years. High-temperature alteration processes include hydrothermal activity associated with impacts and magmatic features. These features may remain active for 104 to 106 years. Table 2 summarizes speculated duration times of these aqueous processes. For comparison, we have determined minimum olivine residence times (time until complete dissolution) for 1 mm diameter particles to range from much less than one year to approximately 5,000 years.

Derived from text

Dissolving; Olivine; Mars Surface; Rates (Per Time); Mineralogy; Planetary Geology

20030066624 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Water Cycling in the North Polar Region of Mars

Tamppari, L. K.; Smith, M. D.; Bass, D. S.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

To date, there has been no comprehensive study to understand the partitioning of water into vapor and ice clouds, and the associated effects of dust and surface temperature in the north polar region. Ascertaining the degree to which water is transported out of the cap region versus within the cap region will give much needed insight into the overall story of water cycling on a seasonal basis. In particular, understanding the mechanism for the polar cap surface albedo changes would go along way in comprehending the sources and sinks of water in the northern polar region. We approach this problem by examining Thermal Emission Spectrometer (TES) atmospheric and surface data acquired in the northern summer season and comparing it to Viking data when possible. Because the TES instrument spans the absorption bands of water vapor, water ice, dust, and measures surface temperature, all three aerosols and surface temperature can be retrieved simultaneously. This presentation will show our latest results on the water vapor, water-ice clouds seasonal and spatial distributions, as well as surface temperatures and dust distribution which may lend insight into where the water is going.

Derived from text

Mars Surface; Polar Regions; Water Vapor; Ice Clouds; Mars Atmosphere

20030066625 California Inst. of Tech., Pasadena, CA, USA

Martian Climactic Events Inferred from South Polar Geomorphology on Timescales of Centuries

Byrne, S.; Ingersoll, A. P.; Pathare, A. V.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The solid CO₂ reservoir at the southern pole of Mars, which survives the entire summer, has been known to exist for decades. Mars Global Surveyor data have revealed this residual deposit to contain a rich variety of geomorphic features. One of the most ubiquitous classes of features on the residual cap are the flat-floored quasi-circular pits with steep walls, dubbed Swiss-cheese features. In this work we report on statistical properties of different Swiss-cheese populations within the residual cap. We use results from a model we have developed to attempt to infer the recent history from such properties as the size distribution and other measured geomorphic parameters. We find evidence of changing environmental conditions on the residual cap over timescales of Martian centuries.

Derived from text

Mars Surface; Planetary Geology; Climate Change; Geomorphology; Planetary Composition; Environment Models; Climate Models

20030066628 Geological Survey, Flagstaff, AZ, USA

Mars: Updating Geologic Mapping Approaches and the Formal Stratigraphic Scheme

Tanaka, K. L.; Skinner, J. A., Jr.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

At the Fourth Mars Conference in 1989, Tanaka reviewed the stratigraphy and geologic history of Mars that had emerged based on systematic geologic mapping of the planet's surface using Viking data. This review looked at the stratigraphic column for Mars and assessed the global geologic history in terms of impact, fluvial, periglacial, aeolian, volcanic, and tectonic processes. Many significant new studies using Mars Global Surveyor (MGS) and now Mars Odyssey (MO) data are showing some important new insights and discoveries that are altering and deepening previous understandings. If we were to illustrate

the current state of the science, we might compare it to a loose-leaf notebook in which pages are rapidly being added, removed, and rewritten, with plenty of room remaining. Much of the flux is due to new data, of course, but also much can be attributed to the re-examination of basic assumptions and approaches and our ability to employ ever more powerful computer techniques. Here, we will attempt to review, based on our experience, the areas where the most change seems to be occurring, what prospects we face in the immediate future, and where caution needs to be exercised.

Derived from text

Conferences; Mars Surface; Planetary Geology; Planetary Mapping; Stratigraphy

20030066629 NASA Ames Research Center, Moffett Field, CA, USA

AstroBioLab: A Mobile Biotic and Soil Analysis Laboratory

Bada, J. L.; Zent, A. P.; Grunthaner, F. J.; Quinn, R. C.; Navarro-Gonzalez, R.; Genez-Silva, B.; McKay, C. P.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Jet Propulsion Laboratory, Scripps Institution of Oceanography, and NASA Ames Research Center are currently developing a mobile Astrobiology Laboratory (AstroBioLab) for a series of field campaigns using the Chilean Atacama Desert as a Martian surface analog site. The Astrobiology Science and Technology for Exploring Planets (ASTEP) program funded AstroBioLab is designed around the Mars Organic Detector (MOD) instrument and the Mars Oxidant Instrument (MOI) which provide complementary data sets. Using this suite of Mars Instrument Development Program (MIDP) and Planetary Instrument Definition and Development Program (PIDDP) derived in situ instruments, which provide state-of-the-art organic compound detection (attomolar sensitivity) and depth profiling of oxidation chemistry, we measure and correlate the interplay of organic compounds, inorganic oxidants, UV irradiation and water abundance. This mobile laboratory studies the proposition that intense UV irradiation coupled with low levels of liquid water generates metastable oxidizing species that can consume moderate amounts of seeded organic compounds. Results from the initial spring 2003 field campaign will be presented.

Author

Mars Surface; Soils; Oxidation; Measuring Instruments; Electrophoresis; Mars Surface Samples

20030066630 NASA Johnson Space Center, Houston, TX, USA

Meridiani Planum Hematite Deposit: Potential for Preservation of Microfossils

Allen, C. C.; Westall, F.; Longazo, T. G.; Schelble, R. T.; Probst, L. W.; Flood, B. F.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Christensen et al., using data from the Mars Global Surveyor Thermal Emission Spectrometer (TES), have identified gray crystalline hematite in a 350 km by 750 km region near Meridiani Planum. The deposit corresponds closely to the low-albedo highlands unit sm, mapped as a wind-eroded, ancient, subaqueous sedimentary deposit. Christensen et al. interpreted the Meridiani Planum deposit to be an in-place, rock-stratigraphic sedimentary unit characterized by smooth, friable layers composed primarily of basaltic sediments with approximately 10 to 15% crystalline gray hematite. The Meridiani Planum hematite deposit has recently been designated as the prime landing site for one of the two Mars Exploration Rover (MER) spacecraft. The MER landings are scheduled for January, 2004. Christensen et al. discussed five possible mechanisms for the formation of this deposit: direct precipitation from standing, oxygenated, Fe-rich water; precipitation from Fe-rich hydrothermal fluids; low-temperature dissolution and precipitation through mobile groundwater leaching; surface weathering and coatings; thermal oxidation of magnetite-rich lavas. Four of these mechanisms involve the interactions of rock with water, and thus have implications in the search for evidence of microbial life.

Derived from text

Hematite; Mars Exploration; Mars Surface; Microorganisms; Sediments; Precipitation (Chemistry)

20030066631 Coimbra Univ., Coimbra, Portugal

Rationale for the Deployment of a Magnetic Gradiometer on Mars

Alves, E. I.; Madeira, V. M. C.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

In this paper we intend to show how a classic geophysical exploration tool on Earth magnetic gradiometry can, if deployed on the surface of Mars, increase our knowledge of the planet's life sustainability. As important by-products, a geomagnetic

gradients traverse could help us select a landing site for the first human explorers and also increase our knowledge of the geology and geological evolution of Mars.

Derived from text

Geomagnetism; Magnetometers; Mars Surface; Magnetic Measurement; Planetary Magnetic Fields

20030066632 Centre National de la Recherche Scientifique, Orsay, France

Warrego Valles Revisited Using MGS and Odyssey Data: Valleys Formed by Precipitations?

Ansan, V.; Mangold, N.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Different processes have been involved to explain valley networks: (1) Fluvial surface runoff formed by precipitation, (2) Groundwater sapping, (3) water-lubricated debris flows, (4) groundwater flow (5) runoff formed by geothermal and/or tectonic activity. Surface runoff could explain the strong erosion of Noachian craters [1], but surface runoff has been criticized because of the low drainage density [2] and alternative hypothesis have been proposed in cold climate [3]. Flows sustained by regional hydrothermal activity have been involved especially for the Thaumasia region in which Warrego networks because of the association of runoff sources with old volcanoes and fault zone [4]. In this study we in firm this possibility and we show that fluvial activity by precipitation is still a possible process to form Warrego valleys. Evidences for such processes are taken from new MGS and Odyssey data thanks to which a more precise evolution of Warrego vallis can be proposed.

Author

Mars Surface; Valleys; Erosion; Topography

20030066633 McGill Univ., Montreal, Quebec, Canada

Polar Wander of Mars: Evidence from Magnetic Anomalies

Arkani-Hamed, Jafar; Boutin, Daniel; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

We present the paleomagnetic pole positions of Mars determined through modeling 16 small magnetic anomalies. The previous 10 anomalies were extracted from a 50-degree spherical harmonic model of the magnetic potential of Mars (Arkani-Hamed, 2001b) that was derived on the basis of the low-altitude data. The original data had many wide gaps parallel to the satellite tracks and the number of original tracks passing over each anomaly was limited. The track data used by Hood and Zakharian (2001) were also extracted from the low-altitude data and suffered from the same limited coverage. The vast amount of high-altitude magnetic data now available provides a good opportunity to verify the previous results and also identify and model additional isolated anomalies. Hood and Richmond (2003) used the new data to model two new anomalies in the low latitudes. The pole position determined from one of the anomalies fall within the 30 degree cluster mentioned above. The present study not only includes 6 additional magnetic anomalies and uses a huge amount of the high-altitude data available, but also employs a new space domain algorithm that incorporates all three components of the magnetic data.

Author

Mars (Planet); Magnetic Anomalies; Paleomagnetism; Polar Wandering (Geology)

20030066634 Space Systems Finland, Espoo, Finland

Defining the Technical Requirements for Subsurface Mars Driller

Anttila, M.; Ylikorpi, T.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The international plans for robotic Mars exploration are focusing on the subsurface sampling and sample analysing methods of Martian regolith. In the launch window of 2009, both ESA and NASA have preliminary plans to send a rover with deep-drilling capabilities. International companies and organisations have designed prototypes and engineering test models for drilling purposes, such as the MRoSA2 driller, Rosetta driller and several other planetary drilling applications. Authors of this publication have been personally involved in especially the ESA's MRoSA2 project. The focus was to develop a prototype of miniaturized planetary driller, which could perform up to 2 meter deep drilling and sampling of Martian regolith. As the drillers are evolving and plans are for moving from prototypes to real space applications regarding the 2009 launch window, it is imperative to conduct wide testing for these drilling and sampling machines. With the knowledge and scientific results gained from the NASA s Pathfinder, Mars Global Surveyor and Odyssey missions we have developed a test bench to simulate

Martian regolith from the surface down to two meters depth. All drilling parameters have been studied to define the best suitable drill performance that could fulfill the requirements for upcoming exploration missions.

Author

Drills; Mars Surface; Regolith; Robotics; Drilling; Core Sampling

20030066640 Hawaii Univ., Honolulu, HI, USA

Igneous and Aqueous Processes on Mars: Evidence from Measurements of K and Th by the Mars Odyssey Gamma Ray Spectrometer

Taylor, G. Jeffrey; Boynton, W.; Hamara, D.; Kerry, K.; Janes, D.; Keller, J.; Feldman, W.; Prettyman, T.; Reedy, R.; Brueckner, J., et al.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

We report preliminary measurements of the concentrations of K and Th on Mars. Concentrations of K and Th and the K/Th ratio vary across the surface. Concentrations are higher than in Martian meteorites, suggesting that most of the crust formed by partial melting of enriched mantle. The average Th concentration (1.1 ppm), if applicable to the entire crust, implies a maximum thickness of about 65 km. The variation in the K/Th ratio suggests that aqueous processes have affected the chemistry of the surface.

Derived from text

Mars Surface; Planetary Geology; Potassium; Thorium; Optical Measurement; Planetary Composition; Mars Atmosphere; Planetary Crusts

20030066644 Tokyo Univ., Japan

Volumetric/Morphometric Analysis of Impact Craters in the Northern Hemisphere Lowlands, Mars

Kurita, K.; Ogawa, Y.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

At the early stage of the martian history, a dense thick atmosphere has been suggested to exist. Considering the present state of thin atmosphere, large amount of CO₂ should be stored somewhere in the martian crust. To detect, characterize and quantify this volatile reservoir is one of the important tasks expected for the geomorphological study on the martian surface features. To determine the amount of this reservoir and to understand its formation process are the direct target of these researches. Among several surface features morphology of impact craters is expected as an potential measure for the subsurface reservoir of the volatiles since excavation process associated with cratering efficiently plows the subsurface region. Several investigations have been conducted on rampart craters. Barlow and Bradley suggest the target properties containing the volatiles control the lobate structure. Kuzmin report spatial distribution of subsurface volatiles based on the onset size of rampart crater. Costard focuses on the extent of fluidized ejecta to infer the volatile distribution. Here we will report results of volumetric/morphometric analysis of fresh impact craters in Utopia Planitia and south of Acidalia regions with an intention to characterize subsurface reservoir of volatiles.

Derived from text

Craters; Morphology; Carbon Dioxide; Geomorphology; Landforms; Mars Surface; Volumetric Analysis

20030066647 Tokyo Univ., Yayoi, Japan

Melting of the Martian Permafrost by Hydrothermal Convection Associated with Magmatic Intrusion

Ogawa, Y.; Yamagishi, Y.; Kurita, K.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Many surface features on Mars are closely connected with the subsurface permafrost layer. The polygonal fractures and the possible thermokarsts are observed on the martian surface and they are analogous to the terrestrial features located on the permafrost. The rampart and/or fluidized ejecta morphology of martian craters is indicative of subsurface volatiles. Mars should stock much water in a form of ground ice. The suspected fluvial features on Mars would suggest water (or its mixture), which is coming from the subsurface aquifer or the ground ice. Such a martian hydrothermal system has been the alternative idea to the assumption of precipitation for forming observed fluvial-like features on Mars. The outflow channels, in particular, have characteristics unique to water erosion and clearly indicates the surface runoff of huge amount of water, which usual precipitations could not supply. The outflow channels potentially suggest the pre-existence of a substantial amount of liquid

water very close to the martian surface to cause a large flood. The idea of supplying such massive liquid water near the ground might be still controversial, however, from many observational facts, we assume that the igneous melting of the martian permafrost layer should have played a significant role. We have numerically simulated the generation of meltwater and are proposing a consistent scenario of forming the outflow channels as well as the headwater regions; chaotic terrains.

Derived from text

Mars Surface; Melting; Hydrothermal Systems; Convection; Permafrost

20030066648 Academy of Sciences (USSR), Moscow, USSR

Mars Electromagnetic Sounding Experiment (MARSES): Comparative and Calibration Studies on the Example Spatial and Temporal Variations Subsurface Geoelectrical Sections of the Saltwater Interface on Sicily (Donnalucata Beach) and Shelter Island

Ozorovich, Y. R.; Lukomski, A. K.; Zoubkov, B.; Babkin, F.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The MARSES is the sounding instrument program on the base new portable geophysical instrumentation developed of searching for water, water-ice or permafrost layers existing in some depth under the visible surface of Mars. The first task is to measure the soil properties of the subsurface of Mars, which include porosity, electrical resistance of the liquid phase, thermal conductivity, temperature dependence and so on. A main task of the MARSES experiment is to examine changes in subsurface properties of local areas regolith on the martian subsurface, and to relate them to optical images and other remote sensing data in order to understand the nature of different terrain forms and structure of cryolitozone of Mars. On the basis of results of several expedition programs in the earth s conditions the optimum configuration of devices and techniques of measurement which allows to receive spatial geoelectrical structure subsurface horizons near martian landers or rover study area in the future martian missions is revealed. During cooperation within the frames of space research missions devoted to Mars exploration, which soil slice conditions are close to Earth's arid and semiarid lands, was developed compact, light and reliable instrument for subsurface sounding and mapping for Earth's applications, and more specifically it relates to a method to map, track, and monitoring: groundwater, groundwater channels, groundwater structures, subsurface pollution plumes, maps interconnected fracture or porous zones, map leaks in earthen dams, map leaks in drain fields, monitor changes in subsurface water flow, monitoring changes in ion concentration in groundwater, monitor in situ leaching solution, monitor movement of heap leaching solutions, monitor changes in subsurface redox or reaction fronts, monitor underground chemical reactions, monitoring subterranean bioreactions, or other subsurface water and related geological structure.

Author

Mars Exploration; Electromagnetic Measurement; Ground Water; Soils; Remote Sensing; Water

20030066649 Brown Univ., Providence, RI, USA

Impacts into Porous Volatile-rich Substrates on Mars

Schultz, P. H.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The current mantra 'follow the water' focuses research in order to understand fundamental aspects of Martian climate history and the possibility of past (or even present) life. The multi-lobed ejecta around craters is often used as evidence for water at depth. However, this 'evidence' is often an assumption used to draw a conclusion. At issue are the underling processes that control the different styles of ejecta emplacement. Experiments theory and data for Martian crater ejecta all indicate that the range of ejecta morphologies can be accommodated without the presence of water (or at least without water as the controlling parameter). The key parameter is the characteristic post-impact grain size that can be entrained in intense vortices created by the expanding ejecta curtain in the presence of an atmosphere, even at late times. This insight provides an alternative use for impact ejecta morphologies: a probe for assessing Martian lithologies. The presence of volatiles (including bound water or water/ice) may play a secondary role.

Derived from text

Impact; Ice; Mars Craters; Mars Surface; Porosity; Water

20030066650 Washington Univ., Saint Louis, MO, USA

Origin and Evolution of Layered Deposits in Meridiani Planum

Seelos, F. P. IV; Arvidson, R. E.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Multiple remote sensing data sets were used to identify, characterize, map, and understand the origin and evolution of the hematite-bearing deposits and associated units in the Meridiani Planum region of Mars. MOLA and MOC (WA and NA) data were used in combination to identify and map surface units based on planimetric configuration, topography, brightness, and texture and to infer superposition and embayment relationships. The boundary of the hematite-bearing deposits was delineated using the hematite index threshold as defined by Christensen et al. Surface properties of these units were then characterized using MOLA intra-shot pulse width derived RMS roughness and TES-based albedo, thermal inertia, and spectral emissivity. The data indicate that: (a) the hematite-bearing unit is the remnant of the top stratum of a widespread layered complex that was deposited onto dissected cratered terrain; (b) the complex was covered by a extensive sedimentary mantle; (c) the entire region has been subjected to differential aeolian erosion that has stripped the mantle, exposing underlying materials that in turn have been partially eroded by wind; and (d) the layered complex was emplaced as flows and tephra deposits, and the unusual albedo and spectral properties are consistent with alteration involving aqueous fluids, either during or after emplacement.

Derived from text

Albedo; Hematite; Mars Surface; Surface Properties; Thermal Emission; Topography

20030066651 California Inst. of Tech., Pasadena, CA, USA

McMurdo Crater: A Unique Impact Event on the South Polar Layered Deposits

Schaller, E. L.; Murray, B. C.; Byrne, S.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

McMurdo crater is a 23 km diameter impact crater located on the edge of the South Polar Layered Deposits (SPLD) at -84. S, 0W. It is the largest fresh impact crater on the SPLD and has a secondary field that extends over approximately 100 km across Planum Australe to the south. The northern half of McMurdo opens to the low lying plains on which the secondary field has been completely removed. Understanding the formation and evolution of the SPLD is an important step toward unraveling Martian climate history. The SPLD, with their characteristic layering and young apparent age, suggest that recent climate change has occurred on Mars. McMurdo and its secondary craters are important stratigraphic markers which can shed light on the modification history of the SPLD.

Derived from text

Craters; Impact; Deposits

20030066652 NASA Goddard Space Flight Center, Greenbelt, MD, USA

TES Limb-Geometry Observations of Aerosols

Smith, Michael D.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Thermal Emission Spectrometer (TES) on-board Mars Global Surveyor (MGS) has a pointing mirror that allows observations in the plane of the orbit anywhere from directly nadir to far above either the forward or aft limbs for details about the TES instrument). Nadir-geometry observations are defined as those where the field-of-view contains the surface of Mars (even if the actual observation is at a high emission angle far from true nadir). Limb-geometry observations are defined as those where the line-of-sight of the observations does not intersect the surface. At a number of points along the MGS orbit (typically every 10 deg. or 20 deg. of latitude) a limb sequence is taken, which includes a stack of overlapping TES spectra from just below the limb to more than 120 km above the limb. A typical limb sequence has approx. 20 individual spectra, and the projected size of a TES pixel at the limb is 13 km.

Derived from text

Aerosols; Mars Global Surveyor; Mars Surface; Field Of View

20030066653 Colorado Univ., Boulder, CO, USA

Theory of Ground Ice on Mars and Implications to the Neutron Leakage Flux

Mellon, M. T.; Feldman, W. C.; Prettyman, T. H.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Near-surface ground ice (subsurface ice in the upper several meters of the martian surface) is an important component of the global cycles of water and the behavior of the martian climate. It represents a substantial reservoir of water that can

dynamically exchange with the atmosphere on timescales comparable to that of oscillations in the planet's orbit. As the martian obliquity increases or decreases, the global atmospheric humidity also increases or decreases. In response to this and changes in the regolith temperatures, ground ice can undergo cycles of sublimation and condensation, such that the upper meter or two of the martian regolith can become alternately ice-saturated and desiccated. The rate of sublimation and condensation is fast enough to respond to orbital changes, but slow enough that the distribution of ice in one year may not reflect the climate conditions that year, but instead will reflect an average over the previous thousand or so years. Therefore, the present day distribution of ground ice reflects some measure of the longer-term martian climate. In this work we present new calculations of the geographic and depth distribution of ground ice on Mars and draw comparisons with the inferred distribution of ice from Mars Odyssey Neutron Spectrometer observations.

Derived from text

Mars Environment; Mars Surface; Planetary Geology; Ice; Neutrons; Leakage; Mars Atmosphere

20030066654 Southwest Research Inst., San Antonio, TX, USA

MarsFlo: A General Tool for Simulating Hydrological Processes in the Subsurface of Mars

Painter, S. L.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Although recent spacecraft observations have provided important new information about the present state of the near-surface hydrological system, significant uncertainties about the deeper hydrological system and the past system remain. Numerical simulations used in combination with spacecraft or lander-based observations have an important role in testing hypotheses and in placing constraints on the hydrological system. Previous modeling studies have relied on computer codes designed to address specific processes, usually in one spatial dimension but occasionally in three dimensions. General-purpose simulation codes addressing the range of relevant physical processes and conditions in the Martian subsurface conditions have yet to be developed. The Southwest Research Institute is currently developing a non-isothermal, multiphase simulation code adapted for the conditions of the Martian subsurface. The goal is to provide the Mars research community with a general simulation tool (MarsFlo) that can be used to test hypotheses about the current and past state of the Mars subsurface hydrological environment in multiple spatial dimensions.

Derived from text

Mars (Planet); Mars Surface; Hydrology; Mathematical Models; Computerized Simulation

20030066655 California Univ., Santa Cruz, CA, USA

Automated Feature Extraction and Hydrocode Modeling of Impact Related Structures on Mars: Preliminary Report

Plesko, C. S.; Asphaug, E.; Brumby, S. P.; Gisler, G. R.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

We have begun a systematic, combined modeling and observation effort to correlate Martian impact structures craters and their regional aftermaths to the impactors, impact processes and target geologies responsible. When the cratering process is modeled in 3D, so that azimuthal heterogeneity is accommodated, one can seek best-fits to regional or even global distributions of radial fractures, crater rays and secondary streamers. We are pursuing this cratering work on two fronts, (1) using automated feature extraction techniques to identify the extensive impact-related features on Mars, and (2) leveraging these impact features through impact modeling (using the 3D SPH and SAGE hydrocodes) to tell us about the specific target response to impact, and hence Martian geology. We are motivated to do this because the Mars data set is now rich with well-characterized impact features, many of them recent and detailed, and because azimuthal asymmetry in cratering has never been adequately modeled in this context. The asymmetry of crater ejecta (rays and secondary streamers) is probably related to the asymmetry of ejecta from catastrophic disruption events in asteroid disruption¹, a subject which also suggests that the delivery of meteorites from the surface of Mars may be easier to understand in 3D than in 2D.

Derived from text

Mars Craters; Mars Surface; Pattern Recognition; Planetary Geology; Mathematical Models; Hydrology; Automatic Control

20030066656 Los Alamos National Lab., NM, USA

Mid-Latitude Composition of Mars from Thermal and Epithermal Neutrons

Prettyman, T. H.; Feldman, W. C.; Elphic, R. C.; Boynton, W. V.; Bish, D. L.; Vaniman, D. T.; Funsten, H. O.; Lawrence, D. J.; Maurice, S.; McKinney, G. W., et al.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Epithermal neutron data acquired by Mars Odyssey have been analyzed to determine global maps of water-equivalent hydrogen abundance. By assuming that hydrogen was distributed uniformly with depth within the surface, a map of minimum water abundance was obtained. The addition of thermal neutrons to this analysis could provide information needed to determine water stratigraphy. For example, thermal and epithermal neutrons have been used together to determine the depth and abundance of water-equivalent hydrogen of a buried layer in the south polar region. Because the emission of thermal neutrons from the Martian surface is sensitive to absorption by elements other than hydrogen, analysis of stratigraphy requires that the abundance of these elements be known. For example, recently published studies of the south polar region assumed that the Mars Pathfinder mean soil composition is representative of the regional soil composition. This assumption is partially motivated by the fact that Mars appears to have a well-mixed global dust cover and that the Pathfinder soil composition is representative of the mean composition of the Martian surface. In this study, we have analyzed thermal and epithermal neutron data measured by the neutron spectrometer subsystem of the gamma ray spectrometer to determine the spatial distribution of the composition of elements other than hydrogen. We have restricted our analysis to mid-latitude regions for which we have corrected the neutron counting data for variations in atmospheric thickness.

Derived from text

Mars Surface; Mars Atmosphere; Thermal Neutrons; Abundance; Planetary Composition; Stratigraphy; Midlatitude Atmosphere

20030066657 Finnish Meteorological Inst., Helsinki, Finland

Simulations of Mesoscale Circulations and Water Transport in Regions of Water Ice Being Exposed: First 2-D Ensemble Results

Siili, T.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The University of Helsinki's 2D Mesoscale Circulation Model (MCM) has been adapted for Martian conditions in early 1990s to create the University of Helsinki (UH), Division of Atmospheric Sciences (ATM) 2D Mars MCM (MMCM). The model has subsequently been used and developed at both UH/ATM and Finnish Meteorological Institute (FMI), Geophysical Research (GEO) to study a number of martian mesoscale circulations, especially so called surface-induced phenomena. Among the forcing and circulation types are slope and (CO₂ and H₂O) ice edge winds, winds driven by variations in albedo and thermal inertia and horizontal dust optical thickness. A fairly comprehensive description of the model can be found.

Derived from text

Mesoscale Phenomena; Circulation; Water; Ice; Mars Environment; Carbon Dioxide

20030066658 Arizona State Univ., Tempe, AZ, USA

Characterization of the Weathering Products of Antarctic Martian Meteorite Analog Materials and Implications for the Formation of Martian Surface Fines

McAdam, A. C.; Leshin, L. A.; Harvey, R. P.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Understanding the role of water in the Martian near-surface environment is among the highest priorities of NASA's Mars Exploration Program. Surface fines provide the best opportunity to assess the nature of the Martian surface environment, because they are sensitive to the action of water. For example, common soils on the Earth are made up largely of chemically weathered minerals because of the abundance of liquid water. In contrast, lunar fines are produced purely by physical weathering (dominantly meteorite impact), and consist of ground igneous minerals, due to the lack of liquid water on the Moon. Mars' environment is likely somewhere between these extremes. Samples of fines from the Martian surface are not available for analysis, but their return to Earth has been proposed. Through analysis of terrestrial analogs to Martian fines, insight into potential Martian surface processes can be obtained in advance of returned samples.

Derived from text

Mars Surface; Weathering; Planetary Geology; Polar Caps; Mars Atmosphere; Chemical Analysis; Remote Sensing; Minerals

20030066659 Jet Propulsion Lab., California Inst. of Tech., CA, USA

MRO's High Resolution Imaging Science Experiment (HiRISE): Science Expectations

McEwen, A.; Hansen, C.; Bridges, N.; Delamere, W. A.; Eliason, E.; Grant, J.; Gulick, V.; Herkenhoff, K.; Keszthelyi, L.; Kirk, R., et al.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Mars Reconnaissance Orbiter (MRO) is expected to launch in August 2005, arrive at Mars in March 2006, and begin the primary science phase in November 2006. MRO will carry a suite of remote-sensing instruments and is designed to routinely point off-nadir to precisely target locations on Mars for high-resolution observations. The mission will have a much higher data return than any previous planetary mission, with 34 Tb of returned data expected in the first Mars year in the mapping orbit. The mapping orbit is nearly polar, 255 x 320 km above the surface, 12 orbits per day. The HiRISE camera, features a 0.5 m telescope, 12 m focal length, and 14 CCDs. Basic capabilities are summarized.

Derived from text

Mars Missions; Remote Sensing; Spacecraft Instruments; Imaging Techniques; Planetary Mapping

20030066660 Colorado Univ., Boulder, CO, USA

Thermophysical Properties of the Martian South Polar Region

Putzig, E.; Mellon, M. T.; Arvidson, R. E.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Previous analysis of thermal inertia and albedo data from the Mars Global Surveyor (MGS) Thermal Emission Spectrometer (TES) delineated three major surface thermophysical units. A fourth unit of low thermal inertia and low-to-intermediate albedo was found to dominate the region poleward of 65 S. We consider end-member geological explanations for this unit and conclude that reduced density in a relatively coarse-grained or indurated mantle is favored over theories invoking dark, unconsolidated dust. A mechanism for reducing bulk density by ablation of near-surface ground ice is suggested by results from the Mars Odyssey Neutron Spectrometer and is supported by other theoretical and TES spectral studies.

Derived from text

Mars (Planet); Polar Regions; Thermophysical Properties; Mars Surface; Planetary Geology; Southern Hemisphere

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Methane Hydrate Exploration on Mars: A Test Bed for Development of Strategies for Planetary Exploration

Max, Michael D.; Clifford, Stephen M.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

NASA, along with its international partners, has developed a Mars exploration strategy, based on robotic missions, that extends well into the next decade. Because of its proximity to Earth, the abundant evidence for water, and the implications that water has for the development and persistence of life, Mars is also the next likely target for human exploration and colonization. As such, it will also serve as an important test bed for the development of techniques for deep biosphere exploration and resource evaluation for other bodies in the solar system. If the early evolution of the Earth and Mars followed similar paths, then it's possible that methanogenic bacteria may have developed in the planet's early aqueous surface and near-surface environment. During the transition of the early Martian hydrosphere to the colder conditions that characterize the planet today, such early life may have adapted to subpermafrost conditions similar to the present deep biosphere environment of the Earth. The potential existence of such a deep microbial biosphere on Mars has enormous implications for the potential development of life, and the availability of methanogenically-produced resources, elsewhere in the solar system (such as the putative deep mantle ocean of Europa).

Derived from text

Biosphere; Microorganisms; Extraterrestrial Oceans; Methane; Planetary Geology; Mars Surface; Geomorphology

20030066662 Brown Univ., Providence, RI, USA

Characterizing Polar Layered Deposits at the Martian North Pole: An Assessment of Local Variations

Milkovich, S. M.; Head, J. W., III; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Within the northern residual polar cap of Mars are dark lanes or troughs; on the walls of these exposures are layered deposits. These deposits consist of extensive lateral layers of ice and dust and are found throughout the polar cap. They were first identified in Mariner 9 images and later studied in detail with the Viking orbiters. In these images, the layers appear to consist of alternating sequences of light and dark layers approximately 5 to 25 m thick. Recent data taken by the Mars Orbiter Camera (MOC) onboard the Mars Global Surveyor (MGS) reveal that the layers are thinner and more numerous than Viking

images suggested. Layers are seen with thicknesses at the limit of resolution (approximately 2 m) and it is possible that smaller scale layers may also exist. The individual layers show considerable variation in thickness, ranging from several meters (the limit of resolution) to several tens of meters. Some layers are observed to pinch out. Additionally, layers show varying resistance to erosion. In particular, a marker bed 20 m thick with resistant knobs approximately 10 m wide is observed in many places.

Derived from text

Remote Sensing; Mars Surface; Planetary Geology; Polar Caps; Atmospheric Models; Terrain

2003006663 Nevada Univ., Reno, NV, USA

Water and Hematite: On the Spectral Properties and Possible Origins of Aram, Meridiani, and Candor

Calvin, W. M.; Fallacaro, A.; Baldrige, A.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Terra Meridiani hematite area was recently selected as one of two final landing sites for the Mars Exploration Rovers. This selection was based in part on the spectral signature from the Mars Global Surveyor Thermal Emission Spectrometer experiment (MGS-TES) that shows a strong signature of bulk grey hematite in the region [1,2]. Both aqueous and non-aqueous processes have been used to account for the presence of this material [2,3,4,5]. Calvin [6,7,8] has long argued for the presence of alteration minerals in medium to low albedo regions and we have recently demonstrated the correlation between the TES hematite locations and those spectra from the Mariner 6 and 7 Infrared Spectrometer (IRS) that suggest increased water of hydration [9]. As the bulk hematite does not include hydration features it suggests the presence of other, associated hydrated minerals at the site and supports an aqueous formation mechanism. We here summarize the Mariner IRS evidence for increased water, explore the observations by the French Imaging Spectrometer for Mars (ISM) over these regions and consider possible scenarios for the concurrent deposition of bulk hematite and hydrated minerals.

Author

Mars Surface; Hematite; Spectral Signatures; Minerals

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MGS-MOC Observations of Martian Dust Storm Activity

Cantor, B. A.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Mars Observer Camera (MOC) completed its second consecutive Martian year of monitoring on December 12, 2002, since entering its mapping orbit on March 9, 1999. During this time the narrow-angle (NA) camera has been taking snapshots of the surface at a resolution of 3-40 m/pixel, while the two wide-angle (WA) cameras, which cover two wavelength bands spanning from the blue (400-450 nm) to the red (575-625 nm), have been continuously mapping the dayside of Mars at a constant resolution of 7.5 km/pixel. Because the WA cameras have a 140 FOV, which allows for limb-to-limb views of the planet, the local time across these low-resolution images ranges from 12:17 to 15:43 at the equator. Some overlap exists between images taken on consecutive orbits, allowing for complete global coverage of the planet to be obtained in two colors in only 12 to 13 orbital passes or about once per a sol. The MGS-MOC experiment has provided an unique opportunity to study Martian weather phenomena, ranging from dust devils and dust storms to condensate clouds to the seasonal behavior of the Martian polar caps, all on time scales ranging from semi-diurnally to interannually. We present here a brief description of the dust activity observed by MOC during the past 2 Mars years in terms of the interannual invariability/ variability of these events. MOC has observed dust events across much of the planet from the depths of Hellas basin to the summit of Arsia Mons. These events range in size from dust devils to planet encircling dust veils.

Author

Mars (Planet); Dust Storms; Planetary Mapping

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Enigmatic Landforms in Cydonia: Geospatial Anisotropies, Bilateral Symmetries, and Their Correlations

Carlotto, M. J.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Geospatial terrain statistics and object symmetries of enigmatic landforms in Cydonia are examined and correlations

identified. Analysis of Viking image-derived MDIM data over Cydonia shows directional anisotropies in the spatial autocorrelation (variogram) at medium to long wavelengths. One is in the direction of the crustal dichotomy in this part of Mars, along with two others at 103.7 and 164.2 . Anisotropies in similar directions at shorter wavelengths (down to tens of meters) are evident in the variograms of Viking, THEMIS, and MGS images within this area. The spatial autocorrelation structure of selected regions in Viking images show indications of rectilinear geometry (directional anisotropies approximately 90 deg. apart) similar to that of highly eroded terrestrial archaeological ruins. Previous analyses of THEMIS and MGS imagery reveal a high degree of bilateral symmetry in several landforms. We show the axes of symmetry are roughly in line with the directional anisotropy at 164.2 noted above.

Author

Mars Surface; Landforms; Terrain; Mars Photographs

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A Case for Hydrothermal Gray Hematite in Aram Chaos

Catling, D. C.; Moore, J. M.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Thermal Emission Spectrometer (TES) on Mars Global Surveyor has detected deposits of coarsegrained, gray crystalline hematite in Sinus Meridiani, Aram Chaos, and Vallis Marineris [1]. Detailed features in the hematite spectral signature of the Sinus Meridiani region show that the spectrum is consistent with emission dominated by crystal c-faces of hematite, implying that the hematite is specular [2]. Gray specular hematite (also known as specularite) is a particular gray crystalline form that has intergrown, hexagonal plates with a silvery metallic luster. We believe that the key to the origin of specularite is that it requires crystallization at temperatures in excess of about 100 C. In reviewing the occurrence of gray hematite on Earth, we find no exceptions to this warm temperature requirement [3]. Thermal crystallization on Mars could occur (1) as diagenesis at a depth of a few kilometers of sediments originally formed in lowtemperature waters, or (2) as direct precipitation from hydrothermal solution. Aram Chaos has unique chaotic terrain that offers more clues to the formation of the hematite than the relatively featureless flat terrain (as seen from orbit) of Sinus Meridiani. Aram Chaos provides the opportunity to look at a combination of TES data, Mars Orbiter Camera images, and Mars Orbiter Laser Altimeter (MOLA) topography. This combination of data suggests that high concentrations of hematite were formed in planar strata and have since been exposed by erosion of an overlying light-toned, caprock. Lesser concentrations of hematite are found adjacent to these strata at lower elevations, which we interpret as perhaps a lag deposit. The topography and the collapsed nature of the chaotic terrain favor a hydrothermally charged aquifer as the original setting where the hematite formed. An alternative sedimentary origin requires post-depositional burial to a depth of ~3-5 km to induce thermally driven recrystallization of fine-grained iron oxides to coarse-grained hematite.

Author

Topography; Mars Surface; Spectral Signatures; Hematite; Geochemistry

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Mars Mission Optimization Based on Collocation of Resources

Chamitoff, G. E.; James, G. H.; Barker, D. C.; Dershowitz, A. L.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

This paper presents a powerful approach for analyzing Martian data and for optimizing mission site selection based on resource collocation. This approach is implemented in a program called PROMT (Planetary Resource Optimization and Mapping Tool), which provides a wide range of analysis and display functions that can be applied to raw data or imagery. Thresholds, contours, custom algorithms, and graphical editing are some of the various methods that can be used to process data. Output maps can be created to identify surface regions on Mars that meet any specific criteria. The use of this tool for analyzing data, generating maps, and collocating features is demonstrated using data from the Mars Global Surveyor and the Odyssey spacecraft. The overall mission design objective is to maximize a combination of scientific return and self-sufficiency based on utilization of local materials. Landing site optimization involves maximizing accessibility to collocated science and resource features within a given mission radius. Mission types are categorized according to duration, energy resources, and in-situ resource utilization. Optimization results are shown for a number of mission scenarios.

Author

Mars Missions; Algorithms; Site Selection; Planetary Mapping; Landing Sites

20030066668 European Space Research Organization, Noordwijk, Netherlands

The Mars Express Mission and Its Beagle-2 Lander

Chicarro, A. F., et al.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The European Space Agency and the scientific community have performed concept and feasibility studies for more than ten years on potential future European missions to the red planet (Marsnet, Intermarsnet), focusing on a network of surface stations complemented by an orbiter, a concept which is being implemented by the CNES-led Netlander mission to be launched in 2005. Before that, however, the ESA Mars Express mission includes an orbiter spacecraft and a small lander module named Beagle-2 in remembrance of Darwin's ship Beagle. The mission, to be launched in 2003 by a Russian Soyuz rocket, will recover some of the lost scientific objectives of both the Russian Mars-96 mission and the ESA Intermarsnet study, following the recommendations of the International Mars Exploration Working Group (IMEWG) after the failure of Mars-96, and also the endorsement of ESA's Advisory Bodies that Mars Express be included in the Science Programme of the Agency. The specific scientific objectives of the Mars Express orbiter are: global high-resolution imaging with 10 m resolution and imaging of selected areas at 2 m/pixel, global IR mineralogical mapping, global atmospheric circulation study and mapping of the atmospheric composition, sounding of the subsurface structure down to the permafrost, study of the interaction of the atmosphere with the surface and with the interplanetary medium as well as radio science. The goals of the Beagle-2 lander are: geology, geochemistry, meteorology and exobiology of the landing site.

Author

Mars Missions; Meteorology; Infrared Imagery; Imaging Techniques; Mars Atmosphere; Geochemistry

20030066669 Carnegie Institution of Washington, Washington, DC, USA

Global Dispersion of Dust Following Impact Cratering Events on Mars

Cho, J. Y-K; Stewart, S. T.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Hypervelocity impacts on Mars inject dust and vapors into the upper atmosphere. If the particles (derived from the projectile or surface) are widely distributed, impact events could drive intense weather patterns and perhaps transient climate change on Mars [1]. Recent work on small impact events find that the mass of dust stirred into the troposphere may be equivalent to global dust storms [2]. For approx. 10 to approx. 100 km-sized impactors, dust and greenhouse vapors may be delivered to the upper troposphere and lower stratosphere, where the long residence time has the potential for regional or even global effects on the weather. In this work, we investigate the mechanisms that control the dispersion of dust injected into the upper troposphere from large impact events, using a high-resolution global atmospheric dynamics model. The spreading rates, dispersal extent, and the potential for weather and climatological perturbations from both medium-sized (approx. 10 km) impactors and giant (approx. 100 km) impactors are studied. The overarching goals in this study are to identify locations of persistent concentrations of aerosols and to estimate the smallest impact which may generate transient rainfall on Mars.

Author

Mars Environment; Dust Storms; Aerosols; Rain

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Factors Controlling the Position of the Martian Magnetic Pileup Boundary

Crider, D. H.; Acuna, M.; Vignes, D.; Krymskii, A.; Breus, T.; Ness, N.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The magnetic pileup boundary (MPB) at Mars is the position where the dominant ion of the plasma changes from solar wind protons to heavy ions of planetary origin. As such, it is the obstacle to solar wind ions. We investigate the factors that influence the shape and position of the magnetic pileup boundary at Mars in order to better understand the Martian obstacle to the solar wind. Employing MGS data, we determine how the Martian MPB moves in response to factors including solar wind pressure and crustal magnetic fields. We also study the factors affecting the thickness of the MPB. Further, we compare the magnetic pileup boundary to the magnetic barrier at Venus. Direct comparison aids in our interpretation of the physics involved in the solar wind interaction with planets lacking a significant intrinsic magnetic field.

Derived from text

Magnetic Fields; Mars (Planet); Mars Surface; Planetary Crusts; Position (Location); Geomagnetism; Planetary Boundary Layer

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Physical Characteristics, Geologic Setting, and Possible Formation Processes of Spring Deposits on Mars Based on Terrestrial Analogs

Crumpler, L. S.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Spring formation is a predicted consequence of the interaction of former Martian aquifers with structures common to Mars, including basin margins, Tharsis structures, and other structural deformation characteristics. The arid environment and high abundance of water soluble compounds in the crust will have likewise encouraged spring deposit formation at spring sites. Such spring deposits may be recognized from morphological criteria if the characteristics of formation and preservation are understood. An important first step in the current Mars exploration strategy [10] is the detection of sites where there is evidence for past or present near-surface water on Mars. This study evaluates the large-scale morphology of spring deposits and the physical processes of their formation, growth, and evolution in terms that relate to (1) their identification in image data, (2) their formation, evolution, and preservation in the environment of Mars, and (3) their potential as sites of long-term or late stage shallow groundwater emergence at the surface of Mars.

Derived from text

Mineral Deposits; Geomorphology; Planetary Geology; Mars Surface; Analogs; Geological Faults; Springs (Water)

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Viking Lander 1 and 2 Revisited: The Characterisation and Detection of Martian Dust Devils

Ringrose, T. J.; Towner, M. C.; Zarnecki, J. C.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Convective vortices and dust devils have been seen on Mars both in orbital data and meteorological data, as well as lander images. Previous estimates of dust devil activity at the Viking Lander sites have provided information about the seasonal behaviour. To add to this data set, Viking Lander 2 meteorological data has been analysed for the sols 1-60, which have a sufficiently high sampling rate for reliable detection of short-term meteorological phenomena. Convective vortices have been identified from their distinctive meteorological signature, using a phase picker algorithm and categorized by a rating scheme, which considers intensity and confidence of detection. Wherever possible, estimates are made of the core miss distance from the Lander and the predicted diameter of the vortex, assuming a response for the vertical sensitivity of the wind sensor, and estimating a vertical wind profile within a convective vortex based on previous studies. An estimate of maximum wind speed within the vortex is also made and compared to the estimated dust saltation threshold at the landing site to infer if the vortex was dust laden. In total, over the 60 sols of Viking Lander 2, 38 vortices have been detected. It is thought that a few of these vortices are false signals due to lander body interference but 6 of the 38 have sufficient wind speeds to entrain local surface material from the landing site. Diurnal activity is similar to terrestrial behaviour, but with increased early morning activity, which it is inferred is probably due to a lower adiabatic lapse on Mars. Total number statistics seen here give a detection rate of 0.6 vortices per sol, compared to recent results of 2 per sol seen by Mars Pathfinder. These results illustrate how common convective vortices are on Mars and potentially how important dust devils are in shaping the martian surface. As a broad estimate, applying the Mars Pathfinder estimates of dust devil dust loading, the total amount of material lofted in the area of the Viking Lander 2 is of the order of 800 kg per sol per square kilometer. This analysis is in agreement with the earlier study by Ryan and Lucich and adds to the published data by providing data on the diurnal behaviour of convective vortices at the Viking 2 landing site. Further analysis is currently ongoing characterizing convective vortex events from the Viking Lander 1 data.

Derived from text

Mars Surface; Viking Lander 1; Viking Lander 2; Detection; Vortices; Dust Storms

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The South Polar Residual Cap of Mars: Landforms and Stratigraphy

Thomas, P. C.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The south polar residual cap (sprc) of Mars is morphologically distinct from that in the north, and is largely compositionally distinct as well, apparently dominated by CO₂ rather than the H₂O present in the northern residual cap. This

work addresses questions of the history and significance of these distinctive deposits by mapping the many forms using MOC images and MOLA data.

Derived from text

Stratigraphy; Carbon Dioxide; Water; Polar Caps

20030066674 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Geologic Evolution of Mars' North Polar Layered Deposits and Related Materials from Mars Odyssey THEMIS

Vasavada, A. R.; Richardson, M. I.; Byrne, S.; Ivanov, A. B.; Christensen, P. R.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The presence of a thick sequence of horizontal layers of ice-rich material at Mars north pole, dissected by troughs and eroding at its margins, is undoubtedly telling us something about the evolution of Mars climate we just don't know what yet. The North Polar Layered Deposits (NPLD) most likely formed as astronomically driven climate variations led to the deposition of conformable, areally extensive layers of ice and dust over the polar region. More recently, the balance seems to have fundamentally shifted to net erosion, as evidenced by the many troughs within the NPLD and the steep, arcuate scarps present near its margins, both of which expose layering.

Derived from text

Planetary Geology; Climate; Ice; Deposits; Mars Environment

20030066675 California Univ., Los Angeles, CA, USA

Potassium in the Martian Core: Implications for an Early Dynamo

Williams, J.-P.; Nimmo, F.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Planetary geodynamo are driven by thermal or compositional convection in the core. Mars is thought to have possessed a geodynamo which ceased approx. 0.5 Gyr after the formation of the planet. A possible, but ad hoc, explanation for this behavior is an early episode of plate tectonics, which drove core convection by rapid cooling of the mantle. In this paper we examine an alternative scenario: that the Martian core contains several hundred ppm potassium. The radioactive decay of ⁴⁰K provides an extra source of energy to power an early dynamo; its short half-life (1.25 Gyr) ensures that the dynamo will stop early in the planet's history. Recent experimental results suggest that the potassium is likely to partition into the core at the relatively low pressures and high sulfur contents appropriate to Mars. Thus, the presence of potassium in the Martian core provides a natural explanation for the geodynamo behavior without needing to invoke plate tectonics. Our results also suggest that core solidification is unlikely to have occurred, since this would probably prolong the geodynamo for several Gyr. If the core is entirely liquid, this places a lower bound on sulfur content of approx. 5 % by weight.

Author

Potassium; Mars Surface; Solidification; Dynamo Theory

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MGS Observations and Modeling of Martian Lee Wave Clouds

Wood, S. E.; Catling, D. C.; Rafkin, S. C. R.; Ginder, E. A.; Peacock, C. G.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Lee wave clouds form when stable air is deflected vertically by a topographic obstacle and undergoes a wave-like oscillation in the lee of the obstacle. Condensation occurs at the adiabatically-cooled crest of the waves, usually leaving a regular train of clouds aligned orthogonal to the prevailing wind and/or a ship's wake divergent pattern. The existence of lee waves in the Martian atmosphere has been known since Mariner 9. Craters varying in size from a few to hundreds of kilometers commonly generate lee waves on Mars. For larger craters, waves can extend up to nearly 1000 km downstream of their source. The wavelength and propagation characteristics of lee waves are determined by the temperature (stability) and wind profiles of the atmosphere, as well as moisture in the impinging flow, so they allow us to make inferences about the atmospheric structure and dynamics. Also the statistical occurrence of lee wave clouds in preferred seasons and locations allows us to tie lee wave incidence to the general climatic state of the Martian atmosphere. In previous missions, coverage has not been systematic. Mars Global Surveyor (MGS) provides an opportunity to systematically look at the occurrence of lee

waves and correlate this with meteorological predicaments. The only significant limitation from MGS is lack of local time coverage.

Derived from text

Atmospheric Physics; Climatology; Clouds; Wave Propagation; Mars Atmosphere; Lee Waves

20030066677 Guigne International Ltd., Paradise, Newfoundland, Canada

Ice Keel Scour Marks on Mars: Evidence for Floating and Grounding Ice Floes in Kasei Valles

Woodworth-Lynas, Christopher; Guigne, Jacques Yves; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

We present new observations from preliminary analyses of Mars Global Surveyor Mars Orbiter Camera images of surficial features interpreted to be the result of interactions between the keels of floating ice masses on submerged sediment. These narrow, intersecting curvilinear trough-like features are ice keel scour marks and are present in large reaches of the Kasei Valles system. We base our interpretations on the morphology of individual scour marks, on ice keel grounding structures and on local scour mark patterns. We compare these Mars observations with identical contemporary structures forming in an analogous environment in the St. Lawrence River on earth.

Derived from text

Floating; Ice; Mars Surface; Morphology

20030066678 NASA Ames Research Center, Moffett Field, CA, USA

H₂O-Silicate Microphysics in Ascending Volcanic Plumes on Mars

Zent, A. P.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Physical adsorption of water vapor plays a much more significant role in eruptive plume energetics on Mars than on Earth. The total surface area in martian plumes is likely comparable to terrestrial ash, while the erupting magma and ambient atmosphere are drier. Plumes cool rapidly during ascent, and a limited population of H₂O molecules find adsorption sites to be increasingly stable. Release of latent heat of condensation and the onset of moist convection are diminished, delayed, or even prevented by adsorptive interaction. We have developed a 5-component numerical model of the behavior of water in eruptive plumes under Mars-like conditions. We have used the model to study the fate of both juvenile and ambient atmospheric water in the eruption column. Here we investigate the adsorptive interaction of water and silicates as they effect plume dynamics and the partitioning and distribution of H₂O to the martian environment. Our focus is on the role of adsorption in scavenging H₂O from the ascending eruption column, and the possibility that adsorptive scavenging depresses the vapor pressure in the column below the level considered in most eruptive models.

Derived from text

Water; Silicates; Mars Environment; Plumes; Adsorption; Water Vapor; Mathematical Models

20030066679 Washington Univ., Seattle, WA, USA

Investigating Surface Mineralogy, Alteration Processes, and Biomarkers on Mars Using Laser Raman Spectroscopy

Wang, Alian; Jolliff, B. L.; Haskin, L. A.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations

Contract(s)/Grant(s): NAG5-7140; NAG5-10703; NAG5-12684; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Despite a wealth of information from past and ongoing missions to Mars, the capability to determine the mineralogy of surface materials and to connect mineralogy with lithologic characteristics that are diagnostic of the environment in which those materials formed remains inadequate. The 2003 Mars Exploration Rovers (MER) will carry a Mini-TES and a Mossbauer spectrometer, which will provide some detailed mineralogy information. For general characterization of minerals and/or biogenic phases (reduced carbon, PAHs, etc) on the surface of Mars, we have been developing a miniaturized laser Raman spectrometer for in situ analyses -- the Mars Microbeam Raman Spectrometer, MMRS. We are also developing strategies to use Raman spectroscopy as a stand-alone technique and to be used synergistically with other in situ analysis methods in future planetary missions. Through studies of Martian meteorites and terrestrial analogs, we are gaining experience of what compositional and structural information can be obtained on key mineral groups using in-situ Raman measurements. We are developing methods for determining mineral proportions in rocks or soils and identifying rock types from sets of

closely spaced, rapidly acquired spectra. We are studying how weathering and alteration affect the Raman and luminescence features of minerals and rocks, and we are investigating the Raman characteristics of biogenic organisms and their remains. These studies form the scientific basis for in-situ planetary Raman spectroscopy, and they are being done in parallel with instrument development towards a flight version of the MMRS.

Derived from text

Laser Spectroscopy; Mars Surface; Mineralogy; Planetary Geology; Raman Spectroscopy; Biomarkers

20030066680 Geological Survey, Flagstaff, AZ, USA

ISIS Processing Tools for Thermal Emission Spectrometer Data

Becker, K.; Johnson, J. R.; Gaddis, L.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Integrated Software for Imagers and Spectrometers (ISIS) package is a widely used planetary data processing and cartography software system produced by the Astrogeology program of the USGS in Flagstaff, AZ. Recent additions to the ISIS system provide useful tools for extracting and projecting Thermal Emission Spectrometer (TES) data for use with other ISIS programs to process, analyze, and visualize these data, particularly in comparison with other Mars data sets. A general overview of various programs and tools used for extracting and processing TES data are presented.

Derived from text

Spectrometers; Thermal Emission; Systems Integration; Software Engineering; Imaging Techniques; Planetary Geology

20030066681 Cornell Univ., Ithaca, NY, USA

High Spatial Resolution Visible Color Units on Mars from the Mars Odyssey THEMIS/VIS Instrument

Bell, J. F., III; McConnochie, T.; Savransky, D.; Stiglitz, B.; Wolff, M. J.; Christensen, P. R.; Mehall, G.; James, P. B.; Malin, M.; Caplinger, M., et al.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Visible Imaging Subsystem (VIS) on the NASA Mars Odyssey spacecraft's THEMIS instrument has been obtaining high spatial resolution 5-color visible wavelength images of Mars since mapping began in February 2002. VIS is a 1024x1024 interline transfer CCD camera that uses narrowband interference filters bonded to the CCD to acquire multispectral images from Mars orbit at central wavelengths of 425, 540, 654, 749, and 860 nm (25 nm). This abstract describes the newest data reduction and calibration methods used to process VIS data, and presents some initial results on surface color properties at high spatial resolution.

Derived from text

High Resolution; Imaging Techniques; Mars Surface; 2001 Mars Odyssey; CCD Cameras; Spatial Resolution

20030066682 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Pancam: A Multispectral Imaging Investigation on the NASA 2003 Mars Exploration Rover Mission

Bell, J. F., III; Squyres, S. W.; Herkenhoff, K. E.; Maki, J.; Schwochert, M.; Dingizian, A.; Brown, D.; Morris, R. V.; Arneson, H. M.; Johnson, M. J., et al.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

One of the six science payload elements carried on each of the NASA Mars Exploration Rovers (MER; Figure 1) is the Panoramic Camera System, or Pancam. Pancam consists of three major components: a pair of digital CCD cameras, the Pancam Mast Assembly (PMA), and a radiometric calibration target. The PMA provides the azimuth and elevation actuation for the cameras as well as a 1.5 meter high vantage point from which to image. The calibration target provides a set of reference color and grayscale standards for calibration validation, and a shadow post for quantification of the direct vs. diffuse illumination of the scene. Pancam is a multispectral, stereoscopic, panoramic imaging system, with a field of regard provided by the PMA that extends across 360 of azimuth and from zenith to nadir, providing a complete view of the scene around the rover in up to 12 unique wavelengths. The major characteristics of Pancam are summarized.

Derived from text

Imaging Techniques; Mars Exploration; Multispectral Photography; Panoramic Cameras; Mars Roving Vehicles; NASA Space Programs

20030066683 Toledo Univ., OH, USA

The Seasonal Behavior of Water Ice Clouds in the Tharsis and Valles Marineris Regions of Mars: Mars Orbiter Camera Observations

Benson, J. L.; Bonev, B. P.; James, P. B.; Shan, K. J.; Cantor, B. A.; Caplinger, M. A.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations

Contract(s)/Grant(s): NAS7-918; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Mars Orbiter Camera (MOC) was used to obtain global maps of the Martian surface. The maps used were acquired between March 15, 1999 (LS = 110) and July 31, 2001 (L(sub s) = 110), corresponding to approximately one and a quarter martian years. In this work we focused on water ice clouds associated with the surface features of Olympus Mons, Ascraeus Mons, Pavonis Mons, Arsia Mons, Alba Patera, and the Valles Marineris canyon system. Using these data, we have made three types of quantitative measurements to characterize the cloud activity: 1) cloud area and location, 2) cloud height, and 3) cloud optical depth. We have also searched for short period variations in the cloud areas.

Derived from text

Ice Clouds; Mars Volcanoes; Mars Surface; Observation; Cameras; Annual Variations

20030066684 Eotvos Lorand Univ., Budapest, Hungary

Comparison of the Cracking and Fracturing Systems of Phobos and Europa

Berczi, Sz.; Horvath, A.; Illes, E.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Voyager and Galileo images of Europa and the Viking Orbiter images of Phobos revealed the surface cracking and fracture systems of the satellites of Jupiter and Mars. The complex system of lineaments and grooves cover the whole surface of these satellites. Based on earlier studies we compared the main characteristics of these structures and propose a joint model of the layered structure (Phobos) and the tidal fractured structure (Europa). However, more details are needed about the relevance of these models.

Author

Cracking (Fracturing); Europa; Jupiter Satellites; Phobos; Structural Properties (Geology); Mars Surface

20030066685 Florida Space Inst., Cape Canaveral, FL, USA

The New Mars Synthesis: A New Concept of Mars Geo-Chemical History

Brandenburg, J. E.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The New Mars Synthesis (NMS)[4] , drawn from the rich treasure trove of orbiter and lander data, the ever increasing number of Mars Meteorites and a better understanding of Mars analogous environments on Earth, is basically this: Mars and Earth did not strongly diverge from their similar paths 4.0 Billion years ago, in the Early Noachian, they diverged much more recently in geologic time, perhaps as recently as the Early Amazonian. During this period of parallel evolution, Mars and Earth had similar surface conditions in many basic ways. The NMS assumes Mars held biology form early on ,has been geologically active throughout its history, that it had a northern paleo-ocean , that it has high, approximately, 4xLunar , cratering rates[5,6] and that its climate changed recently in geologic time from being basically terrestrial to its present conditions. In the remainder of this abstract, the basic evidences supporting the NMS and models for its functioning planetary systems will be discussed.

Author

Mars Environment; Mars Surface; Geochronology

20030066686 Academy of Sciences (USSR), Moscow, USSR

Effect of Solar Activity in Topside Ionosphere/Atmosphere of Mars: Mariner 9, Viking 1 and 2 and Mars Global Surveyor Observations

Breus, T. K.; Crider, D. H.; Krymskii, A. M.; Ness, N. F.; Hinson, D.; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The peak electron density in the ionosphere of Mars and the neutral atmosphere scale-height are proportional to the solar radiation flux. The data of the radio occultation experiments onboard Mariner 9, Viking 1 and 2 have already been analyzed

to derive the relationship between the neutral atmosphere scale-height and F10.7 flux which was used as a proxy of the solar UV radiation. The data points from Mariner 9, Viking 1 and 2 missions are scattered from 40 deg. to +38 deg. in latitude and rather non-uniformly distributed in longitude. The experiment with the Mars Global Surveyor (MGS) Accelerometer has revealed significant diurnal variations and latitudinal and longitudinal variations in the neutral atmosphere density and scale-height. The effect of the solar radiation can be more confidently established if the effects of diurnal, latitudinal and longitudinal variations are minimized. The 523 electron density profiles derived from the data of the MGS Radio Science experiment, which were collected during the mapping phase of the mission, are located in the narrow latitude interval from +67 deg. to +77 deg. These profiles were also obtained within a narrow interval of local time and are practically uniformly distributed in longitude. The peak electron density and the effective scale-height of the neutral atmosphere density in the vicinity of the ionization peak have been derived for each of the profiles studied. The daily and running 81-day averages of advanced E10.7 index, which are derived from the solar radiation fluxes measured near the Earth and then re-calculated accounting for the position of Mars and the Earth, have been used as a proxy of the EUV radiation flux at Mars. The daily averages of the adjusted peak electron density and effective scale-height have been compared with the daily and running 81-day averages of E10.7 index. The effects of the solar activity derived from of the MGS data are compared with the effects found in the Mariner 9, Viking 1 and 2 data.

Author

Mars Atmosphere; Diurnal Variations; Solar Activity Effects; Atmospheric Density; Electron Density Profiles

20030066687 Virginia Univ., Arlington, VA, USA

Origin of Phobos and Deimos: A New Capture Model

Singer, S. Fred; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The origin of the Martian satellites presents a puzzle of long standing. Conventional hypotheses either violate physical laws or have difficulty accounting for the observed orbits. Both satellites have near-circular and near-equatorial orbits. Phobos orbit has been observed to shrink (since its discovery in 1877), indicating the influence of tidal perturbations. Extrapolating their orbits backward in time yields nearly identical circular orbits at the synchronous limit, followed by parabolic orbits suggesting capture. But there is no obvious mechanism for energy dissipation to capture of these small bodies; nor should such capture yield equatorial orbits. Contemporaneous formation with the planet Mars is contradicted by dynamics. The obliquity of Mars axis, about 25°, indicates formation by stochastic impacts of large planetesimals, at least in the last stages of Mars accumulation. But the equatorial orbits of the satellites would require that the obliquity of Mars changed quasi-adiabatically, i.e., very slowly compared to the orbital periods of the moons. This suggests that Mars acquired the moons only after its formation was completed, but it leaves the mechanism uncertain. With capture and contemporaneous formation both unlikely, we propose a third possibility: Capture of a large Mars- Moon, during or shortly after the formation of the planet, with Phobos and Deimos as its surviving remnants. Arguments are given in favor of such a hypothesis and illustrative examples are shown. Derived from text

Deimos; Phobos; Circular Orbits; Mars (Planet)

20030066688 Brown Univ., Providence, RI, USA

Carbonates on Mars: Probable Occurrences, Spectral Signatures, and Exploration Strategies

Thomson, B. J.; Schultz, P. H.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Carbonates and other aqueous alteration products occur in the SNC meteorites, and spectral observations suggest that carbonate is present in Martian dust as a minor constituent. Analysis of analogous terrestrial dust deposits (loess) in Argentina, which also contain a significant carbonate component, has revealed that post-depositional modification of the loess can result in the re-precipitation of carbonate as concretions and as discrete layers of calcrete. These Argentine deposits give us a roadmap for locating the most accessible carbonate deposits on Mars.

Derived from text

Carbonates; Deposits; Spectral Signatures; Planetary Geology; Mars Surface

20030066689 Geological Survey, Flagstaff, AZ, USA

Temporal and Spatial Distribution of Seasonal CO₂ Snow and Ice

Titus, T. N.; Kieffer, H. H.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The seasonal polar caps are a major element of Mars' climate and global atmospheric circulation. Theoretical calculations and surface pressure measurements indicate that about of the CO₂ in the atmosphere condenses each year to form the seasonal caps. Changes in the polar cap albedo or emissivity modify the polar cap energy budget and the amount of CO₂ condensation, consequently affecting the global martian climate.

Derived from text

Carbon Dioxide; Spatial Distribution; Temporal Distribution; Ice; Snow; Mars Environment

20030066690 Los Alamos National Lab., NM, USA

Correlation of Neutron-sensed Water Ice Margins with Topography Statistics

Tokar, R. L.; Kreslavsky, M. A.; Head, J. W., III; Feldman, W. C.; Moore, K. R.; Prettyman, T. H.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Surface roughness and curvature obtained from high resolution MOLA data are used to characterize a sedimentary mantle at high Martian latitudes, (poleward of approx. 40 deg. - 60 deg.). The equatorward boundary of the mantle correlates with the locations of dissected terrain identified in MOC images. The dissected terrain is thought to be degraded water cemented soil, and the mantle discussed is inferred to be water ice rich. This conclusion is given further support, where a positive correlation of the results is made with Odyssey neutron sensing of high hydrogen content in the near surface soil at high southern latitudes. The Odyssey data are measured by the neutron spectrometer (NS) component of the gamma ray spectrometer (GRS). In this study, the margins between the water ice rich mantle and the relatively dry equatorial region are studied for the northern and southern hemispheres using the Odyssey NS data and the MOLA roughness/ curvature data. The position and extent in latitude of the margin is estimated via simulations of the NS data and the results are compared with average MOLA topography statistics. Preliminary results for two bands of longitude (120 deg. - 150 deg.W and E) in the southern hemisphere are reported here.

Derived from text

Ice; Neutrons; Sensitometry; Topography; Statistical Analysis; Mars Surface

20030066691 Open Univ., Milton Keynes, UK

The Beagle 2 Environmental Sensors: Intended Measurements and Scientific Goals

Towner, M. C.; Ringrose, T. J.; Patel, M. R.; Pullan, D.; Sims, M. R.; Haapanala, S.; Haari, A. -M.; Polkko, J.; Wilson, C. F.; Zarnecki, J. C.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Beagle 2 is a 30kg lander for Mars, optimized for exobiology, launching in June 2003 as part of the European Space Agency (ESA) Mars Express mission[1]. The expected lifetime on the surface is 180 sols, with a landing site in Isidis Planitia. One of the instruments on board is a suite of sensors for monitoring the local environment, and hence helping to determine if life could, or still can, exist there. The suite consists seven sensor subsystems weighing 153 grams, and due to the tight constraints of the Beagle 2 lander, primarily of simple analogue sensors, distributed over the lander. The suite has 2 major themes: A meteorological package will record wind speed and direction, atmospheric pressure and temperature at a variety of heights, and look for particle saltation. A life environment subsystem will measure the local radiation environment, the surface UV flux, and attempt to verify the presence of oxidants such as hydrogen peroxide, (without identifying the particular species present). Additional sensors will record the upper atmosphere density profile (determined by the acceleration encountered during probe entry and descent).

Derived from text

Sensors; Atmospheric Density; Atmospheric Pressure; Atmospheric Temperature; Mars Surface; Hydrogen Peroxide

20030066692 Los Alamos National Lab., NM, USA

Convective Plumes as 'Columns of Life'

Travis, B. J.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

A great deal of evidence supports the statement that water was abundant on Mars in its early history and that much of that inventory still exists today as ice and permafrost in the sub-surface, very likely with liquid water below that. A recent study suggests that liquid water will be subject to widespread hydrothermal convection driven by the geothermal gradient, or the geothermal gradient augmented by magmatic intrusions. Subsurface convective flow patterns for Mars conditions are of the

roll and plume types, with warm, upwelling plumes melting through the permafrost region and approaching closer to the surface and exhibiting higher upward flow rates than rolls. Water temperatures within upwelling plumes can range from 40 - 100 C, at their base, to 0 - 10 C at their top (even colder for saline solutions), depending on local heat flux and permeability structure of the host rock. These convective patterns are stable and long-lasting, and could provide a potential habitat for microbial life by bringing nutrients to and through microbial communities living in subsurface soil and rock. Upwelling plumes could function as columns of life. Further, for the higher geothermal heat fluxes of the past, flow will be episodic, characterized by occasional periods of enhanced flow rates and re-organization of the spatial arrangement of plumes, possibly providing a stimulus for evolution.

Derived from text

Water; Mars Environment; Convection; Plumes

20030066693 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Berlin, Germany

Permafrost-related Morphologies in Tempe Terra: Observations and Morphometry

vanGasselt, S.; Hauber, E.; Jaumann, R.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The fretted terrain at the Martian dichotomy boundary shows various permafrost related morphologies. On the basis of Mars Global Surveyor mission data we perform morphometrical analyses of lobate debris aprons and present typical ice related morphologies from high resolution imagery. A variety of landforms indicates the possible existence of past or present ice in the near subsurface of Mars. Among the most spectacular ice-related features are lobate debris aprons (LDAs). They have been interpreted to be a mixture of rock particles and interstitial ice analogous to terrestrial rock glaciers (debris transport systems comprising a creeping mixture of rock fragments and segregational or interstitial ice).

Derived from text

Creep Properties; Debris; Glaciers; Landforms; Permafrost; Dichotomies

20030066694 Brown Univ., Providence, RI, USA

Accumulation of Distal Impact Ejecta on Mars Since the Hesperian

Wrobel, K. E.; Schultz, P. H.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Dark regions of Mars remain enigmatic. Are they unweathered volcanics? Pyroclastics? Exposed bedrock? Even more enigmatic are the conflicting explanations from spectral studies. Recently it has been suggested that these dark areas may represent impact glasses (or even tektites) emplaced by a nearby crater. However, consideration of the Coriolis force emplaced on ejecta in flight reveals that simple emplacement models are inappropriate. Previous studies have considered the effects of planetary rotation, or the Coriolis effect, on distal ejecta deposition on Mars and Earth. Results of such studies showed that rotational effects are significant for Mars and thus need to be taken into consideration when mapping ejecta distributions. Small particles of ejecta from major impacts have contributed to global surface materials on Mars. In conjunction with this global ejecta layer, the surface also displays these large, concentrated regions of dark materials composed of either enigmatic andesitic materials, such as in Acidalia (Type II) or more mafic materials (Type I). The present study examines this issue further by estimating the total accumulations of possible glasses (distal materials) since the end of the Noachian.

Derived from text

Ejecta; Mars Surface; Mineralogy; Mars Craters; Planetary Geology; Geochronology

20030066695 Arizona State Univ., Tempe, AZ, USA

Basalt, Altered Basalt, and Andesite on the Martian Surface: Observations, Interpretations, and Outstanding Questions

Wyatt, M. B.; McSween, H. Y., Jr.; Christensen, P. R.; Head, J. W., III; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

To classify a volcanic rock accurately, and distinguish it from an altered volcanic surface or sedimentary rock of similar composition, one must utilize an assortment of chemical, mineralogical, and textural analyses. Questions and uncertainties in classifications can arise without a full suite of such measurements as some mineral phases and chemical trends alone are not discriminating factors for assigning petrologic names. Such difficulties are common when classifying rocks on Mars using

in-situ and orbital remote sensing techniques because of a lack of chemical, mineralogical, and textural measurements at comparable spatial and spectral resolutions. We can, however, add a perspective to improve our understanding of the origin and composition of martian surface materials by placing existing compositional measurements into newly emerging geologic contexts. The purpose of this work is to summarize current observations and interpretations of martian low-albedo surface compositions, focusing on those derived from the Mars Global Surveyor Thermal Emission Spectrometer (MGS-TES) experiment, and place them into geologic contexts relevant to mapped distributions. Outstanding questions pertaining to the origin and composition of martian low-albedo surface materials are discussed and ongoing work to address these issues is presented.

Derived from text

Andesite; Basalt; Mars Surface; Sedimentary Rocks; Mineralogy; Remote Sensing; Surface Properties

20030066696 NASA Ames Research Center, Moffett Field, CA, USA

Physical Alteration of Martian Dust Grains, Its Influence on Detection of Clays and Identification of Aqueous Processes on Mars

Bishop, Janice L.; Drief, Ahmed; Dyar, Darby; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAG5-12687; NAG5-3871; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Clays, if present on Mars, have been illusive. Determining whether or not clay minerals and other aqueous alteration species are present on Mars provides key information about the extent and duration of aqueous processes on Mars. The purpose of this study is to characterize in detail changes in the mineral grains resulting from grinding and to assess the influence of physical processes on clay minerals on the surface of Mars. Physical alteration through grinding was shown to greatly affect the structure and a number of properties of antigorite and kaolinite. This project builds on an initial study and includes a combination of SEM, HRTEM, reflectance and Mossbauer spectroscopies. Grain size was found to decrease, as expected, with grinding. In addition, nanophase carbonate, Si-OH and iron oxide species were formed.

Derived from text

Clays; Dust; Mars Surface; Planetary Geology; Granular Materials; Mineralogy

20030066697 NASA, Washington, DC, USA

NASA's Mars Exploration Program: Scientific Strategy 1996-2020

Garvin, James B.; McCleese, Daniel J.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

NASA's restructured Mars Exploration Program (MEP) is continuing to unfold with the implementation of the Mars Exploration Rover (MER) mission in summer of 2003, as well as with the continuing science mapping of the Mars Global Surveyor and Mars Odyssey orbiter. In addition, the latest US budget blueprint by the Bush Administration (FY04) indicates that the exploration of Mars will continue to be a priority within NASA's Space Science Enterprise, further cementing the first decade of the new millennium as a prime time to understand the habitability of Mars, including key paleo-environmental aspects of its biological potential. Over the course of the past year, an integrated team of scientists, engineers, and managers has crafted a next decade plan for Mars that covers the period from 2010 to 2020. This paper describes the current program for decade of this program (2009), we may know where and how to look for the elusive clues associated with Martian biology, if any was ever established. With the Viking missions of the mid-1970s, the most intensive and comprehensive robotic expeditions to any Deep Space location in the history of humanity were achieved, with scientifically stunning results. Much has been written about what the Viking landers and their in situ biology experiments did not discover, but more should be recognized of the monumental legacy of information Viking provided about Mars. Although evidence of biological potential was not achieved, the Vikings developed both global and local foundation datasets describing the surface geomorphology, atmosphere, and basic state variables by virtue of their multi-year presence in the martian system.

Derived from text

Mars Exploration; Mars Surface; Planetary Mapping; Viking Mars Program

20030066698 Massachusetts Inst. of Tech., MA, USA

Trade Space Analysis of Mars Surface Explorers

Marquez, J. J.; Hilstad, M. O.; Hines, E. K.; Lamamy, J. A.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

NASA's Mars Exploration Program seeks to answer the question of whether Mars has ever been a habitable world, through study of how geologic, climatic, and other processes have interacted to shape the Martian environment. Alternating orbiter and lander vehicles are planned for upcoming biannual launch windows, potentially resulting in a surface mission once every four years. This infrequency of surface missions makes it important to maximize the potential for useful science return of each landed mission through carefully directed mission design. The motivation for this project arose from the need for a tool to rapidly create and compare system-level Mars rover designs. Specifically, the project resulted in a trade space design and analysis tool that is able to render rover designs applicable to the architecture and design selection of the 2009 Mars mission - the Mars Science Laboratory (MSL) - and to future robotic surface explorers.

Author

Mars Missions; Mission Planning

20030066699 Arkansas-Oklahoma Center for Space and Planetary Sciences, USA

In-Situ Dating on Mars: Procedures and Characterization of Luminescence from a Martian Soil Simulant and Martian Meteorites

Blair, M. W.; Yukihiro, E. G.; Kalchgruber, R.; McKeever, S. W. S.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The thermoluminescence and blue stimulated luminescence signals from the JSC Mars-1 and the Martian meteorite ALH 77005,74 have been characterized in this study. Dose recovery experiments show that radiation doses given in the laboratory can be estimated to within 5% using single-aliquot procedures. The blue stimulated luminescence growth curves suggest that the maximum theoretical estimable dose is approximately 7500 Gy for the JSC Mars-1 sample, and approximately 2500 Gy for the ALH 77005,74 sample. A single-aliquot procedure for coarse-grain feldspars (based on the SAR procedure) has been outlined. The procedure effectively corrects for sensitivity changes in the investigated samples by applying the same preheating regimen after all irradiation doses. Although natural samples with independent age controls have not been dated, known laboratory doses could be recovered to within 5%.

Derived from text

Snc Meteorites; Soils; In Situ Measurement; Mars Surface; Geochronology; Illuminance

20030066700 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA, NASA Goddard Space Flight Center, Greenbelt, MD, USA

High Spectral Resolution Spectroscopy of Mars from 2 to 4 Microns: Surface Mineralogy and the Atmosphere

Blaney, Diana; Glenar, David; Bjorker, Gordon; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations

Contract(s)/Grant(s): RTOP 344-32-51-02; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The composition of the Martian surface and atmosphere on a global scale has been discovered in great part from spectroscopic measurements in the visible through infrared. Spectroscopic observations on Mars however require careful analysis from both atmospheric and mineralogical perspectives. The 2-4 μ m region contains diagnostic absorption features indicative of water such as the 3 μ m bound water band and cation-OH stretches between 2-2.5 μ m. Carbonate minerals also have absorption features in these wavelength range. However, this wavelength region also has atmospheric signatures from CO, CO₂, water vapor, clouds, and atmospheric dust that complicate direct mineralogical interpretations. Several absorption features have been identified in the 2.0 - 2.5 μ m (e.g. Clark et al. 1990, Murchie et al. 1993, Bell et al. 1994) at moderate resolution. These features, while intriguing, are weak, narrow, and frequently at the edge of instrumental and observational limits. Spectroscopic observations at high spectral resolutions can aid in the separation of weak surface and atmospheric absorptions that at lower resolution overlap. This paper focuses on understanding the atmospheric spectral signatures so that the underlying surface mineralogy can be understood.

Derived from text

Mars Atmosphere; Mars Surface; Mineralogy; Spectral Resolution; Spectroscopy

20030066701 Toledo Univ., OH, USA

Modeling the Seasonal South Polar Cap Sublimation Rates at Dust Storm Conditions

Bonev, B. P.; James, P. B.; Wolff, M. J.; Bjorkman, J. E.; Hansen, G. B.; Benson, J. L.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations

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Carbon dioxide is the principal component of the Martian atmosphere and its interaction with the polar caps forms the CO₂ seasonal cycle on the planet. A significant fraction of the atmospheric constituent condenses on the surface during the polar winter and sublimates back during spring. The basic aspects of the CO₂ cycle have been outlined by Leighton and Murray and a number of follow-up theoretical models ranging from energy balance to general circulation models have been used to study the physical processes involved in the cycle. This paper presents a modeling study on the seasonal south polar cap sublimation rate under dust storm conditions. Mars Global Surveyor observations are also presented.

Derived from text

Dust Storms; Polar Caps; Sublimation; Mathematical Models; Mars Atmosphere

20030066702 Brown Univ., Providence, RI, USA

Depth-dependent Thermal Stress on a One-Plate Planet, Mars

Boroughs, L. L.; Parmentier, E. M.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

We calculate the accumulated deviatoric thermal stresses and strains for a one-plate planet such as Mars, using a parameterized thermal evolution model. We determine that global cooling should be a major contributor to stresses on Mars, resulting in stresses large enough to cause compressional faulting of the upper portion of the crust, and perhaps larger than stresses from other sources. Compressional features found globally on Mars including wrinkle ridges, could therefore be explained largely by the cooling of the planet, and our calculated thermal stresses and strains agree with those from wrinkle ridge structural studies. Some workers have previously suggested that surface tectonism on Mars could be the result of a global mechanism, but quantification of such a process has not yet been fully explored. Previous studies have examined thermal stresses for one-plate planets and in lithospheric plates on Earth. Our calculations, use boundary conditions appropriate for a one-plate planet such as Mars, and include the effects of the volume change of the cooling interior, as well as contraction due to temperature changes in the lithosphere. Stresses as a function of depth in the lithosphere are determined by the distribution of cooling with depth, brittle failure near the surface, and viscous relaxation of stresses at greater depths.

Derived from text

Mars (Planet); Mars Surface; Planetary Geology; Thermal Stresses; Mathematical Models

20030066703 Michigan Univ., Ann Arbor, MI, USA

Mars Global Surveyor Radio Science Electron Density Profiles: Interannual Variability and Implications for the Neutral Atmosphere

Bougher, S. W.; Engel, S.; Hinson, D. P.; Murphy, J. R.; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Mars Global Surveyor (MGS) Radio Science (RS) experiment employs an ultrastable oscillator aboard the spacecraft. The signal from the oscillator to Earth is refracted by the Martian ionosphere, allowing retrieval of electron density profiles versus radius and geopotential. The present analysis is carried out on five sets of occultation measurements: (1) four obtained near northern summer solstice ($L_s = 74-116$, near aphelion) at high northern latitudes ($64.7-77.6^\circ\text{N}$), and (2) one set of profiles approaching equinox conditions ($L_s = 135-146$) at high southern latitudes ($64.7-69.1^\circ\text{S}$). Electron density profiles (95 to 200 km) are examined over a narrow range of solar zenith angles ($76.5-86.9$ degrees) for local true solar times of (1) 3-4 hours and (2) 12.1 hours. Variations spanning 1-Martian year are specifically examined in the Northern hemisphere.

Derived from text

Electron Density (Concentration); Mars Global Surveyor; Neutral Atmospheres; Northern Hemisphere; Radio Emission; Annual Variations

20030066704 NASA, Washington, DC, USA

Craters on Mars: Global Geometric Properties from Gridded MOLA Topography

Garvin, J. B.; Sakimoto, S. E. H.; Frawley, J. J.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Impact craters serve as natural probes of the target properties of planetary crusts and the tremendous diversity of morphological expressions of such features on Mars attests to their importance for deciphering the history of crustal assembly, modification, and erosion. This paper summarizes the key findings associated with a five year long survey of the

three-dimensional properties of approx. 6000 martian impact craters using finely gridded MOLA topography. Previous efforts have treated representative subpopulations, but this effort treats global properties from the largest survey of impact features from the perspective of their topography ever assimilated. With the Viking missions of the mid-1970 s, the most intensive and comprehensive robotic expeditions to any Deep Space location in the history of humanity were achieved, with scientifically stunning results associated with the morphology of impact craters. The relationships illustrated and suggest that martian impact features are remarkably sensitive to target properties and to the local depositional processes.

Derived from text

Mars Surface; Mars Craters; Planetary Geology; Topography

20030066705 Brown Univ., Providence, RI, USA

South Circumpolar Ice Sheet on Mars: Regional Drainage of Meltwater Beneath the Hesperian-aged Dorsa Argentea Formation

Ghatan, Gil J.; Head, James W.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The south polar region of Mars is currently the site of an expansive ice cap, covering an area of approximately $1.42 \times 10^{(exp 6)}$ sq km, and composed of two mapped units: Api, a residual, high albedo unit; and Apl, a lower albedo unit that underlies Api, and in places displays bright and dark layering. Age constraints on the present polar cap obtained from crater retention have attributed a surface age for the deposits to the uppermost Amazonian. Surrounding the present polar cap, are a series of deposits, which together compose the Dorsa Argentea Formation. Originally mapped as two units (an upper and lower member), the DAF is asymmetrically distributed about the current polar deposits, forming two main lobes, one centered about 0W longitude and one about 70W longitude, covering an area of $1.52 \times 10^{(exp 6)}$ sq km. The DAF is thought to likely underlie the current polar cap, which would make the unit a circumpolar deposit, with a total area of $2.94 \times 10^{(exp 6)}$ sq km. Crater counts have attributed a Hesperian age to the DAF.

Derived from text

Ice; Mars Surface; Polar Caps; Deposits

20030066706 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands

The ESA Mars Express Mission: Spectral and Compositional Investigations

Martin, P. D.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Within the past 40 years, advances in ground-based remote sensing and significant return of spectral and compositional data from the Martian surface have led to a rapidly increasing knowledge of the surface mineralogy of the planet. These results, combined with progress made in the fields of laboratory measurements and simulations, have permitted better-constrained interpretation of the surface materials, hence allowing for improved understanding and comparisons of the various evolution processes, whether these processes are relevant to weathering and alteration or to more climatic-related changes. It is expected from future missions to bring back a substantial amount of additional compositional data. In particular, the ESA Mars Express spacecraft, due for launch at the beginning of June 2003 and for arrival at Mars at the end of December 2003, will return outstanding, unprecedented stereo images, multi-/hyper-spectral visible/ near-infrared data sets, and UV-infrared spectra. These will be acquired and delivered by the HRSC, OMEGA, PFS and SPICAM instruments, with better spatial and/or spectral coverage than previous Mars missions. The purpose of the investigations to be done with the data from those experiments will be to process and analyze such data sets with the broad scientific objectives of: providing additional essential information and clarifying the debate about the detection, presence, abundance, and mixing degrees of surface constituents such as oxides, hydrates, silicates, clays, frosts, carbonates, sulfates, and palagonitic-like materials. decorrelating the respective contributions of the surface and atmosphere. updating the models of evolution of the Martian surface, in relation with the geologic timescales.

Author

Mars Missions; Mars Surface; Planetary Composition; Planetary Geology

20030066707 NASA Ames Research Center, Moffett Field, CA, USA

Time-dependent Calculations of an Impact-triggered Runaway Greenhouse Atmosphere on Mars

Segura, T. L.; Toon, O. B.; Colaprete, A.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Large asteroid and comet impacts result in the production of thick (greater than tens of meters) global debris layers of 1500+ K and the release through precipitation of impact-injected steam and melting ground ice) of large amounts (greater than tens of meters global equivalent thickness) of water on the surface of Mars. Modeling shows that the surface of Mars is still above the freezing point of water after the rainout of the impact-injected steam and melting of subsurface ice. The energy remaining in the hot debris layer will allow evaporation of this water back into the atmosphere where it may rain out at a later time. Given a sufficiently rapid supply of this water to the atmosphere it will initiate a temporary 'runaway' greenhouse state.

Derived from text

Time Dependence; Computation; Greenhouse Effect; Mars Surface

20030066709 NASA Goddard Space Flight Center, Greenbelt, MD, USA

THEMIS Observations of Atmospheric Aerosol Optical Depth

Smith, Michael D.; Bandfield, Joshua L.; Christensen, Philip R.; Richardson, Mark I.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Mars Odyssey spacecraft entered into Martian orbit in October 2001 and after successful aerobraking began mapping in February 2002 (approximately $L_s=330$ deg.). Images taken by the Thermal Emission Imaging System (THEMIS) on-board the Odyssey spacecraft allow the quantitative retrieval of atmospheric dust and water-ice aerosol optical depth. Atmospheric quantities retrieved from THEMIS build upon existing datasets returned by Mariner 9, Viking, and Mars Global Surveyor (MGS). Data from THEMIS complements the concurrent MGS Thermal Emission Spectrometer (TES) data by offering a later local time (approx. 2:00 for TES vs. approx. 4:00 - 5:30 for THEMIS) and much higher spatial resolution.

Derived from text

Aerosols; Amount; Dust; Ice; Optical Thickness; Spectrometers; Mars Environment

20030066710 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Constraints on the Evolution of the Dichotomy Boundary at 50-90E

Smrekar, S. E.; Raymond, C. A.; Dimitriou, A.; McGill, G. E.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The global dichotomy is a fundamental feature of Mars. It marks the boundary between the highly cratered, older southern highlands, and the northern plains. Recent analysis of buried craters in the northern lowlands confirms the long held suspicion that they are comparable in age to the southern highlands, but with surficial deposits of younger material. A variety of exogenic and endogenic models have been proposed for the origin of the dichotomy, including multiple impacts, plate tectonics, and degree one convection produced by core formation, a plume under the lowlands, or a plume under the highlands. New gravity and topography data from the Mars Global Surveyor (MGS) Mission favor endogenic processes. In this study we examine MGS topography, gravity and magnetic field data to constrain the tectonic history the dichotomy in the region 30-60N and 50-90E, which encompasses portions of the Ismenius Lacus quadrangle. The dichotomy formed very early in the history of Mars and has undergone extensive modification by impact cratering, erosion, and faulting. This history must be carefully interpreted in order to reconstruct the original nature of the dichotomy boundary and ultimately discriminate between models of origin. In the study area boundary-parallel faults are well preserved, and may be the result of gravitational relaxation. The geologic history has been examined in detail, including estimates of volumes of material eroded. Further, it is one of the few regions where there is a correlation between the free air gravity, magnetic anomalies, and the geology. This allows to constrain subsurface faulting beneath the lowlands fill material. In addition to being an excellent location to unravel the complex history of the dichotomy, this area preserves the transition from a highly magnetized highlands crust to an unmagnetized or slightly magnetized lowlands crust.

Derived from text

Dichotomies; Gravitational Fields; Mars Surface; Gravity Anomalies

20030066711 Oxford Univ., Oxford, UK

Aeolian Sediment Transport Pathways and Aerodynamics at Troughs on Mars

Bourke, M. C.; Bullard, J. E.; Barnouin-Jha, O. S.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

This paper focuses on the interaction between trough topography and aeolian sediments on Mars. Using detailed

observations from narrow and wide angle Mars Orbital Camera (MOC) images of troughs in Syrtis Major (and elsewhere), the effects of interaction between regional scale wind patterns and trough topography on aeolian depositional forms are described. We highlight the range of dunes found within the trough, suggest potential sediment sources and consider the role of the trough as a temporary sediment sink and/or store. Using work that has been undertaken on valley-wind interaction on Earth, a preliminary 2d model is developed to investigate similar interactions under Martian conditions. We suggest that, through its impact on aeolian sediment transport pathways, the trough provides an important link (source/sink) for exchange of sediment between different aeolian forms and different parts of the surface. There is a sediment transport continuum between the trough and the aeolian features both within and adjacent to it.

Derived from text

Cameras; Topography; Troughs; Mars Surface; Mineral Deposits; Aerodynamics; Sediment Transport; Wind (Meteorology)

20030066712 Oulu Univ., Finland

Modified Impact Craters: Clues to Martian Geological Processes

Raitala, J.; Aittola, M.; Kostama, V.-P.; Lahtela, H.; Ohman, T.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The most basic type for a small impact crater is a circular bowl depression surrounded by an elevated rim and an ejecta blanket with inverse layering, secondary impact craters and long-reaching thin ray deposits. In the case of larger impact craters and basins this picture is more complicated by a central uplift and internal rings, respectively. The main appearance of the impact craters on the Martian surface depends on the size, mass, velocity, type, and impact angle of the projectile and on the amount of the impact energy delivered into the surface bedrock. In nature, however, there are hardly any two totally identical impact craters or basins. Any deviation from the circular or regular crater shape has a reason and, in many cases, this reason relates either to the bedrock geology or to active geological processes. This fact can be utilized in identifying some of the characteristics and development phases of the Martian geological environment, which has not only interacted in the impact event but also influenced in the subsequent impact crater modification. Every deviation from the regular crater form is based on a reason, which may also be a geological one. The best known examples are the rampart craters with their characteristic ejecta blanket and high or wide central peak which all tell us something of the Martian wet or permafrost-rich environment in the past. This and other impact crater modifications can be found to provide crucial information of the local surface geology, bedrock properties and, more generally, of the geological evolution phases of the area studied.

Author

Planetary Geology; Mars Craters; Mars Surface

20030066713 Brown Univ., RI, USA

Pavonis Mons Fan-shaped Deposit: A Cold-based Glacial Origin

Shean, D. E.; Head, J. W.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Each of the three Tharsis Montes volcanoes on Mars has an unusual fan-shaped deposit located exclusively to the northwest of each shield. The fan-shaped deposits of the Tharsis Montes generally share three major facies: 1) ridged facies, 2) knobby facies, and 3) smooth facies. Here we examine the Pavonis fan-shaped deposit using new Mars Global Surveyor and Mars Odyssey data. Any explanation for the origin of the fan-shaped deposits must take into account both the similarities and differences in their morphologies, their approximately similar Amazonian age, and the fact that all three occur on the westnorthwestern sides of the volcanoes. Based on Viking Orbiter data, several models have been proposed for their formation, including landslides, glacial processes and pyroclastic flows. Williams and Lucchitta suggest that the fanshaped deposits consist of moraines deposited during recession of local ice caps that formed on the volcanoes from mixtures of emanated volatiles and erupted ash. Scott et al suggest an explanation combining glacial and volcanic processes. We have re-examined the fan-shaped deposits utilizing new data from Mars Global Surveyor (MOLA, MOC) and Mars Odyssey (THEMIS, GRS Suite). This analysis, together with an assessment of terrestrial analogs of cold-based glaciers suggests that the Pavonis fan-shaped deposit was formed by cold-based glaciers that existed in recent Martian history. The Pavonis fan-shaped deposit extends approximately 250 km northwest of the shield base along a N35 W trend. The deposit ranges from 3.0-8.5 km above the Mars datum and covers an area of 75,000 sq km, approximately half of the area covered by the Arsia deposit.

Author

Mars Volcanoes; Glaciers; Fans (Landforms); Planetary Geology

20030066714 Hawaii Univ., Honolulu, HI, USA

Evidence for a Thick, Discontinuous Mantle of Volatile-rich Materials in the Northern High-Latitudes of Mars Based on Crater Depth/Diameter Measurements

Boyce, Joseph M.; Mouginiis-Mark, Peter; Garbeil, Harold; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The ultimate goal of this study is to provide insight into the erosion and depositional history of Mars. This study focuses on the surface history of the northern high-latitudes of Mars suggested by depth/diameter (d/D) relationships of craters found within that region. Variation in d/D relationships across this latitude zone suggests the presents of a blanket of materials in the lowlands covering both crater floors and the surround plains north of 45 N. The technique described by [1] was applied to the 1/64 MOLA database in six sample areas (Utopia, Acidailia, North Polar basin, the lowlands north of Protonilus, and the highlands of northern Deuteronilus, and Tempe Terra) in order to search for spatial variations in d/D. Depth and Diameter for a total of 1023 craters, ranging from about 2 km to over 100km diameter were measured in sample areas. Unlike previous d/D studies that only measured depth from the crater rim to its floor (dR/D), the difference in elevation between the surface surrounding the crater and the crater floor was also measured for each crater (ds/D).

Derived from text

Mars Craters; Highlands; Latitude; Mars Surface; Planetary Mantles; Morphology; Volatility; Depth

20030066715 National Air and Space Museum, Washington, DC, USA

Basin Hypsometry on the Earth, Mars, and the Moon

Grant, J. A; Fortezzo, C.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Martian valley networks and their associated drainage basins have been the focus of numerous morphometric studies geared towards understanding the source of water responsible for their evolution. These studies often have yielded mixed results that suggest rainfall, sapping, or a combination thereof have all served as sources for valley incisement. The availability of Mars Global Surveyor Mars Orbiter Laser Altimeter (MOLA) topographic data, however, now enables quantitative assessment of basin area versus elevation characteristics [3-5] that may shed new light on important processes influencing valley formation and resultant characteristics.

Derived from text

Mars Surface; Elevation; Water

20030066716 Arizona State Univ., Tempe, AZ, USA

Gusev Crater, Mars, as a Landing Site for the Mars Exploration Rover (MER) Project

Greeley, Ronald; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Gusev crater is about 160 km in diameter, centered at 184.5 W, 14.3 S, in the southern cratered highlands near the border with the northern lowlands. The floor of this impact crater has been approved as a landing site for MER. The geological history of Gusev crater has been mapped and studied in detail by numerous investigators. Hypotheses for the origin(s) and modification(s) of the materials on the floor of the crater (the proposed site for the MER landing) include volcanic, aeolian, fluvial, glacial, mass-wasting, and lacustrine processes and environments. The Athena scientific payload on MER will enable testing these and other hypotheses, the results of which will contribute to the overall goals and objectives of the Mars Exploration Program.

Author

Mars Craters; Volcanoes; Landing Sites; Geology

20030066717 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Evolution of Volatile-rich Crater Interior Deposits on Mars

Russell, Patrick S.; Head, James W.; Hecht, Michael H.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

This paper discusses how geologic processes on Mars introduced deposits of volatile materials into impact craters after their formation. Specific craters on Mars are profiled.

Author

Volatile Organic Compounds; Planetary Composition; Mars Craters; Planetary Geology

20030066718 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Can MARSIS Measure the Low-Altitude Components of the Mars Magnetic Field?

Safaenili, A.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Measuring the magnetic field anomaly of Mars at low altitudes (e.g. 100-200 km) can be an interesting application of Mars Advance Radar for Subsurface and Ionospheric Sounder (MARSIS). Due to a low HF operation frequency, the radio wave propagating in the ionosphere of Mars, over the magnetic anomaly regions, will be affected and distorted by the localized magnetic field. This distortion in the sounder signal is due to the Faraday rotation and provides information about the strength of the magnetic field. MARSIS is especially sensitive to the radial magnetic field at altitudes where the electron density in the ionosphere peaks (i.e. 100-200 km). Consequently, MARSIS is potentially capable of providing measurements for the radial component of the magnetic field at altitudes between 100 to 200 km that are normally out of reach for orbital magnetometers (with the exception of the aero-braking phase). Such low-altitude measurements would be complementary to already existing measurements at 400 km by MAG-ER on Mars Global Surveyor. This paper will explain the sensitivity of MARSIS as a magnetometer and the method envisioned to measure the radial magnetic field component. MARSIS (Picardi et al.), the first major planetary radar sounder, is the result of an international collaboration between NASA, the Italian Space Agency (ASI), and European Space Agency (ESA), and will arrive at Mars in early 2004 for a two-year mission. MARSIS has a frequency range between 0.1-5.5 MHz and is designed to penetrate the subsurface to a depth of a few kilometers. MARSIS primary objective is to map and characterize the subsurface geological structure of Mars, and search for subsurface liquid water reservoirs. The secondary objective of MARSIS is to study the ionosphere of Mars providing the most extensive amount of data on Martian ionosphere to date. In addition to MARSIS, a second radar sounder named SHARAD (SHallow RADar) with operation frequency of 15-25 MHz is under development. SHARAD is an Italian instrument (Seu et. al) that will fly on NASA's Mars Reconnaissance orbiter in 2005. SHARAD can also provide magnetic measurements, however, it is not expected to be as sensitive as MARSIS to magnetic field variations.

Author

Mars Atmosphere; Planetary Ionospheres; Magnetic Measurement; Atmospheric Sounding; Mars Missions

20030066719 Schneck (Therese), USA

Mars Noachian

Schneck, Therese; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The early universe during its first years was opaque to the electromagnetic radiation. The light we are presently observing from large quasars group over 9 billion light years away had to cross such a distant to reach us that it actually left the group before the earth was formed. The Degree Angular Scale Interferometer (DASI) based near the South Pole produced detailed maps of CMBR variation and polarization: the shape of spacetime is flat. The sun is surrounded by a plasma not fully ionized and the velocity of the electromagnetic radiation is reduced when moving through such a medium. Solar UV radiation increase from solar minimum to solar maximum. Atmospheric CO₂ has varied considerably at the Ordovician on Earth. An inventory was made to establish a curve transition between atmospheric carbon dioxide and atmospheric oxygen at Late Ordovician-Early Silurian 430 Million years ago. Solar physics models have suggested that short term solar output cause a solar luminosity 4.5 percent less than today. On Mars, the release of CO₂ consistent with Hawaiian basaltic lavas and H₂O to the atmosphere from magma erupted and during Tharsis formation could have produced the integrated equivalent of a 1.5 bar CO₂ atmosphere. The martian meteorite ALH84001 has retained noble gases for 4 billion years. The magnetic dichroism or spin polarized light in iron, magnetite (Fe₃O₄), formed anerobically with the loss of carbon dioxide and oxidized in a redox reaction Fe²⁺ to Fe³⁺, by loosing electron. The magnetite and the weathered carbonate reflectance spectra exhibit distinctive narrow features. The magnetosphere of Mars and the atmosphere rise ceased at the end of the Noachian (between 4.4 and 3.8 billion years ago) before the end of heavy bombardment.

Author

Mars Atmosphere; Atmospheric Composition; Planetary Geology; Carbon Dioxide Concentration

20030066720 Honeybee Robotics Ltd., New York, NY, USA

Strategies for Future Mars Exploration: An Infrastructure for the Near and Longer-Term Future Exploration of the Subsurface of Mars

Gorevan, S. P.; Myrick, T. M.; Batting, C.; Mukherjee, S.; Bartlett, P.; Wilson, J.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The development of an optimal strategy for the exploration of the subsurface of Mars requires insight into consideration of recent and ongoing technological advances in subsurface exploration platforms. Honeybee Robotics is a leading NASA supported developer of electromechanical subsurface exploration systems. The depth accessible through technologies under development at Honeybee extends from 5 mm to over 100 meters below the Martian surface. The types of subsurface exploration systems that cover the depths in between the extremes of that range are extensive and is representative in principle to systems also being developed at other institutions here in the US and around the world. Systems under development are not just limited to the sampling of the subsurface. Novel approaches to comprehensive borehole science access are also under development. An overview of the range of subsurface exploration approaches is offered as a potential vertical infrastructure that can assist in the design of future in-situ science and sample return missions to Mars. Interaction with experts at subsurface access, mission planners and science users is expected to produce an optimized subsurface exploration strategy.

Derived from text

Mars Missions; Mars Surface; Strategy

20030066721 NASA Johnson Space Center, Houston, TX, USA

Fine-grained Goethite as a Precursor for Martian Gray Hematite

Glotch, T. D.; Morris, R. V.; Sharp, T. G.; Christensen, P. R.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Several isolated deposits of gray, crystalline hematite on Mars were discovered using data returned from the Thermal Emission Spectrometer (TES) instrument aboard the Mars Global Surveyor spacecraft. Christensen et al. provided five testable hypotheses regarding the formation of crystalline hematite on Mars: 1) low-temperature precipitation of Fe oxides/hydroxides from standing, oxygenated, Fe-rich water, followed by subsequent alteration to gray hematite, 2) low-temperature leaching of iron-bearing silicates and other materials leaving a Fe-rich residue (laterite-style weathering) which is subsequently altered to gray hematite, 3) direct precipitation of gray hematite from Fe-rich circulating fluids of hydrothermal or other origin, 4) formation of gray hematitic surface coatings during weathering, and 5) thermal oxidation of magnetite-rich lavas. Since this initial work, several authors have examined the hematite deposits to determine their formation mechanism. Lane et al. cited the absence of a 390/ cm absorption in the martian hematite spectrum as evidence for platy hematite grains. Their model for the formation of the deposits includes deposition of any of a variety of iron oxides or oxyhydroxides by aqueous or hydrothermal fluids, burial and metamorphism to gray platy hematite grains, and exhumation in recent times. Based on a detailed geomorphic examination of the Sinus Meridiani region, Hynek et al. conclude that the most likely method of hematite formation was either emplacement by a hydrothermal fluid or oxidation of a magnetite-rich pyroclastic deposit. Similarly, Arvidson et al., favor a model involving the alteration of pyroclastic deposits by aqueous or hydrothermal fluids. Finally, based on geochemical modeling and an examination of Aram Chaos, Catling and Moore favor emplacement by hydrothermal fluids with a minimum temperature of 100 C. Comparison of the average martian hematite spectrum measured by TES to hematite emissivity spectra for a variety of naturally occurring hematites shows small but potentially important differences. In particular, band shapes, positions and relative band emissivities of hematite spectra vary over the range of samples. These differences imply that the natural variability of thermal infrared hematite spectra has not been fully characterized, especially with respect to the reaction pathway and crystal structure.

Derived from text

Hematite; Crystal Structure; Mars Surface; Oxidation; Water

20030066722 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Mars Exploration Rover Landing Site Selection

Golombek, M.; Grant, J.; Parker, T.; Kass, D.; Crisp, J.; Squyres, S.; Adler, M.; Haldemann, H.; Carr, M.; Arvidson, A., et al.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Selection of the landing sites for the Mars Exploration Rovers has involved over 2 years of research and analysis effort that has included the participation of broad sections of the planetary sciences community through a series of open landing site

workshops. The effort has included the definition of the engineering constraints based on the landing system, mapping those engineering constraints into acceptable regions and prospective sites, the acquisition of new information from Mars Global Surveyor and Mars Odyssey orbiters, the evaluation of science and safety criteria for the sites, and the downselection and final site selection based on the sites science potential and safety. The final landing sites (Meridiani Planum and Gusev crater) were selected by NASA Headquarters on April 11, 2003, prior to launch in June. This paper presents engineering requirements, and potential landing sites for Mars Exploration Rovers.

Derived from text

Mars Exploration; Mars Landing Sites; Mars Surface; Mars Roving Vehicles; Site Selection

20030066723 Tennessee Univ., Knoxville, TN, USA

Early Accretion and Its Effect on the Thermal History of Mars

Ghosh, A.; Weidenschilling, S. J.; Nimmo, F.; McSween, H. Y., Jr.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Thermal evolution models provide insights into a wide spectrum of questions related to the evolutionary history of Mars ranging from the processes of core, crust and mantle separation, to formation of the hemispherical dichotomy and the Tharsis region. Accretion models of Mars in the 1970 s based on the work on estimated a timescale of accretion of Mars between 100 - 1500 Myrs. Thus, early thermal evolution models of Mars assumed cold post-accretion initial temperatures. Dynamical modeling by suggested significant heating by large impacts during accretion, leading thermal modelers to construct models for an initially hot Mars. Most thermal models until now have retained the assumption of approx. 100 Myr accretion timescale, and consequently have considered heating only by long-lived radionuclides. Another category of models computed thermal histories of early Mars by taking into account the impact energy and/or the heat of core formation. Theoretical support for rapid accretion was provided by recognition of 'runaway growth,' that allowed bodies in a planetesimal swarm to attain large sizes before velocities are stirred up, in a shorter interval of time than previously recognized. Plausible swarm parameters allow runaway embryos to grow as large as Mars on a timescale approx. 1 Myr or a hundredth of the time suggested that Mars might be a surviving embryo produced by runaway growth. The idea of faster accretion and differentiation is supported by a host of isotopic systems. Hf-W systematics indicate that accretion, core segregation, and large-scale silicate melting on Mars was complete by approx. 10 Myrs with respect to CAI formation. A possible explanation for silicate depletion (relative to metal sulfide) and planetary density for Earth and Mars might be the lack of a protracted accretion stage (that produces giant impacts) for Mars. The fast accretion of Mars in timeframes of ~1 Myr brings into play a significant role for ²⁶Al in early thermal evolution, since the heat generated per unit mass per unit time by this radionuclide is greater than the combined heat produced by all other short- and long-lived radionuclides, for at least the first 5 Myrs after CAI formation.

Derived from text

Astronomical Models; Depletion; Energy Of Formation; Evolution (Development); Mars (Planet); Temperature Distribution

20030066725 Blackhawk Geoservices, Inc., Golden, CO, USA

Comparison of Ground-Penetrating Radar and Low-Frequency Electromagnetic Sounding for Detection and Characterization of Groundwater on Mars

Grimm, R. E.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Two orbital, ground-penetrating radars, MARSIS and SHARAD, are scheduled for Mars flight, with detection of groundwater a high priority. While these radars will doubtlessly provide significant new information on the subsurface of Mars, thin films of adsorbed water in the cryosphere will strongly attenuate radar signals and prevent characterization of any true aquifers, if present. Scattering from 10-m scale layering or wavelength-size regolith heterogeneities will also degrade radar performance. Dielectric contrasts are sufficiently small for low-porosity, deep aquifers that groundwater cannot be reliably identified. In contrast, low-frequency (mHz-kHz) soundings are ideally suited to groundwater detection due to their great depths of penetration and the high electrical conductivity (compared to cold, dry rock) of groundwater. A variety of low-frequency methods span likely ranges of mass, volume, and power resources, but all require acquisition at or near the planetary surface. Therefore the current generation of orbital radars will provide useful global reconnaissance for subsequent targeted exploration at low frequency. Introduction: Electromagnetic (EM) methods

Derived from text

Ground Water; Planetary Surfaces; Mars Surface; Low Frequencies; Ground Penetrating Radar; Electromagnetic Radiation; Sound Transducers

20030066726 Aarhus Univ., Denmark

Optical Detection of Magnetic and Electrically Charged Dust Particles on Mars

Gunnlaugsson, H. P.; Jensen, J.; Kinch, J. M.; Merrison, J. M.; Madsen, M. B.; Nornberg, P.; Rasmussen, K. R.; Walgren, H.; Weyer, G.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The data from the Pathfinder mission have given a significantly better picture of the properties of the magnetic dust suspended in the Martian atmosphere. However, new questions have been raised, related to the properties of the dust and the potential of using the dust to learn more about atmosphere surface interactions. These questions have stimulated interest in the development of an instrument that could measure the accumulation of magnetic dust to permanent magnets with a better resolution (in both time and mass) than was possible during the Pathfinder mission. Recent experiments performed under Martian conditions on the electrical properties of Mars analogue dust have shown that the dust is electrically charged, in the sense that it is attracted by electrodes. The dust was found to be both positively and negatively charged in roughly equal amounts. The charging does not seem to originate from collision processes, and surface chemistry has been suggested. We have developed a small instrument, based on optical detection of dust on surfaces. In this contribution, the scientific objectives that could be addressed with such an instrument will be described, and results obtained under simulated Martian conditions are given.

Derived from text

Optical Measurement; Mars Surface; Lunar Dust; Electric Charge; Detection; Magnetic Properties

20030066727 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Gusev and Meridiani Will Look Different: Radar Scattering Properties of the Mars Exploration Rover Landing Sites

Haldemann, A. F. C.; Larsen, K. W.; Jurgens, R. F.; Slade, M. A.; Butler, B. J.; Arvidson, R. E.; Harmon, J. K.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Analysis of all existing radar data for the two Mars Exploration Rover (MER) landing sites at Meridiani Planum and Gusev Crater suggest that their meter-scale morphological appearance will be noticeably different than previous Mars landing sites; their human-scale, decimeter-to meter-scale roughness is not the same as for previous Mars landing sites. We make this prediction based on a comparison of the MER landing sites.

Derived from text

Mars Exploration; Mars Landing Sites; Radar Scattering; Planetary Geology

20030066728 Brown Univ., Providence, RI, USA

Characteristics and Distribution of the Mars North Polar Basal Unit

Fishbaugh, Kathryn E.; Head, James W., III; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Beneath much of the northern polar layered deposits lies a dark, platy unit noted by a few authors and described in detail by Byrne and Murray and Edgett et al. We have continued the investigation of this unit by examining MOC images and MOLA data (looking forward to the release of spring/summer THEMIS data) of the polar cap and of the features interpreted by Fishbaugh and Head as polar material remnants and glacial retreat features. Here we discuss the broad characteristics, two example outcrops, and the distribution of the Basalt Unit (BU). In another abstract in this volume, we examine possible origins and modifications of the BU.

Derived from text

Basalt; Distribution (Property); Polar Caps; Mars (Planet); Mars

20030066729 Brown Univ., Providence, RI, USA

Mars North Polar Stratigraphy and Implications for Geologic History

Fishbaugh, Kathryn E.; Head, James W., III; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Introduction: We have continued investigation of the dark, layered, and possibly sand-rich unit beneath the north polar

deposits begun by previous authors [1-4] and have described the detailed characteristics of this basal unit (BU) [5-7; Fishbaugh and Head, abstract in this volume]. While Kolb and Tanaka [2] describe the BU as consisting of early north polar deposits, Byrne and Murray [3] suggest that such a significant change in deposition style has taken place that the unit must represent a period in time when there was no polar cap. They believe that the BU consists of ice-rich paleoerg deposits that migrated to the low elevation plains underlying the current polar deposits. In addition to these possibilities, we suggest that the unit may have initially been deposited by outflow channels and/or a paleo-ocean. Here we examine three possible origins for this unit (paleopolar deposits, outflow channel/oceanic deposits, and eolian deposit) and three possible ways in which it may have been modified since its formation (paleoerg, incorporation into basal ice, and basal melting with subsequent redistribution). Figure 1 shows the geographic context and topographic relationships of the BU, north polar cap, and the surrounding plains. Possible Origins: We present three possible modes of formation of the BU and three possible ways in which it may have been modified since its formation.

Author

Stratigraphy; Mars Surface; Planetary Geology; Topography

20030066730 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Intercomparison of Atmospheric Radiation Schemes for the Lower Martian Atmosphere

Crisp, D.; Harri, A.-Matti; Savijarvi, H.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Interpretation of the vast data flow from the recent and ongoing Mars missions requires extensive modeling activity to support the investigations and conclusions drawn from the observations. We have initiated a campaign to compare atmospheric radiation schemes for the lower Martian atmosphere with least-compromise reference line-by-line calculations (Meadows and Crisp 1996, Crisp 1986). By using fixed reference conditions we are introducing an intercomparison framework to enable atmospheric modeling teams to compare their modeling results with the reference line-by-line calculations, and to improve their models. The atmosphere of Mars is thin and therefore its response to local radiative forcing is strong when compared to that of the Earth's troposphere. Airborne dust and also the water vapor give significant contributions to the radiative fluxes. Thus models of the Martian atmosphere should have fairly accurate radiative transfer (RT) algorithms. This is specifically important for the net radiative flux at the surface, which is the main driver for the surface temperature evolution, since the surface turbulent fluxes are small due to the thin atmosphere (e.g. Haberle et al. 1993, Savijarvi 1991a, Savijarvi 1991b, Savijarvi 1999). However, the accuracy of the RT schemes has not been rigorously tested in many cases as reference calculations have been rare. We introduce a set of reference cases for Martian atmospheric conditions with profiles for temperature, pressure, dust optical depth (Conrath 1975, Clancy et al. 1995, Ockert-Bell et al. 1997, Smith et al. 2000), water, CO₂, O₃, CO and O₂ (Table 1). The reference atmosphere uses a diurnally and globally averaged thermal structure derived from Mariner 9 IRIS observations acquired during late southern summer. Thermal structures for nighttime and daytime conditions will be included shortly. Computationally expensive reference simulations were performed by applying a spectrum resolving (line-by-line multiple scattering) model, SRM, to give the least-compromise base for comparisons. We call for other groups to join in future comparisons. This resembles the International Comparison of Radiation Codes for Climate Models (ICRCCM; e.g. Ellingson and Fouquart 1991, Ellingson et al. 1991). The ICRCCM led to many improvements in the Earth GCM radiation codes. The intercomparison framework presented in this paper is a step toward that direction for Mars. We have already five modeling teams participating in this intercomparison exercise. Additional teams investigating the Martian atmosphere are cordially invited to join this effort of comparing the radiation schemes in fixed conditions. The results achieved will be reported and some additional features to be included in the intercomparison will be discussed.

Derived from text

Atmospheric Radiation; Mars Atmosphere; Mars Surface; Atmospheric Models; Temperature Profiles

20030066731 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Berlin, Germany

Target Selection and Image Planning for the High Resolution Stereo Camera (HRSC) on the ESA Mars Express Mission - and a Target Database for Mars Exploration

Hauber, E.; Neukum, G.; Kortenien, J.; Roatsch, T.; Matz, K.-M.; Jaumann, R.; Pischel, R.; Hoffmann, H.; Hauber, Ernst; Neukum, G., et al.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The High Resolution Stereo Camera (HRSC) onboard the European ESA Mars Express (MEX) mission will map greater than 50% of the Martian surface in stereo and colour with a resolution of less than or equal to 15 m/pixel. In order to optimize the scientific return of the instrument, the preparation of a detailed list of surface targets and their specific scientific interest

together with ancillary information is mandatory. We describe the organization of the list of greater than 1500 individual targets, the parameters specified for each target, and how the list will be used in operations planning. Finally, we outline possible further applications of the list for upcoming Mars missions like the Mars Reconnaissance Orbiter.

Derived from text

Cameras; Data Bases; High Resolution; Mars Exploration; Mars Missions; Targets; European Space Agency

20030066732 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

What is the Time Scale for Orbital Forcing of the Martian Water Cycle?

Hecht, M. H.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Calculation of the periodic variations in the martian orbital parameters by Ward and subsequent refinements to the theory have inspired numerous models of variation of the martian water cycle. Most of these models have focused on variations in planetary obliquity on a both a short-term (110 kyr) time scale as well as larger oscillations occurring over millions of years. To a lesser extent, variations in planetary eccentricity have also been considered. The third and fastest mode of variation, the precession of the longitude of perihelion, has generally been deemphasized because, among the three parameters, it is the only one that does not change the integrated annual insolation. But as a result of this precession, the asymmetry in peak summer insolation between the poles exceeds 50%, with the maximum cycling between poles every 25.5 kyrs. The relative contribution of these different elements to orbital forcing of climate takes on particular importance in the context of apparently recent water-related features such as gullies or polar layered deposits (PLD). Christensen, for example, recently identified mantling of heavily gullied crater walls as residual dust-covered snow deposits that were responsible for the formation of the gullies in a previous epoch. Christensen assumed that the snow was originally deposited at a period of high obliquity which was stabilized against sublimation by a lag deposit of dust. It is suggested here that not obliquity, but the short-term oscillations associated with precession of the perihelion may play the dominant role in the formation of gullies, major strata in the polar layered deposits (PLD), and other water-related features.

Derived from text

Hydrological Cycle; Mars Surface; Periodic Variations; Climatology; Water

20030066733 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Analysis of Properties of the North Polar Layered Deposits: THEMIS Data in Context of MGS Data

Ivanov, A. B.; Byrne, S.; Richardson, M. I.; Vasavada, A. R.; Titus, T. N.; Bell, J. F.; McConnochie, T. H.; Christensen, P. R.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

One of the many questions of Martian exploration is to uncover the history of Mars, through analysis of the polar layered deposits (PLD). Martian polar ice caps hold most of the exposed water on the surface on Mars and yet their history and physical processes involved in their formation are unclear. We will attempt to contribute to our knowledge of the composition and stratigraphy of the polar deposits. In this work we present the latest imaging data acquired by the Mars Odyssey Thermal Emission Imaging System (THEMIS) and place it into context of the Mars Global Surveyor (MGS) data. THEMIS provides capabilities for imaging in both thermal IR and visible color wavelengths. These observations are affected by atmospheric scattering and topography. The Mars Orbiter Laser Altimeter (MOLA) and Thermal Emission Spectrometer (TES) instruments on board of the MGS spacecraft can provide context information for THEMIS data. Of particular interest are Mars Orbiter Camera (MOC) images, which provide high resolution data. We are primarily interested in the seasonal evolution of ice cap temperatures during the first northern summer of THEMIS observations. Morphology, stratigraphy and composition of the layered deposits can be addressed by THEMIS VIS color images, along with MOC high resolution data and MOLA Digital Elevation Models (DEM). This work is intentionally descriptive. Based on the knowledge obtained by the orbiting spacecraft and described here, we will attempt to expose major directions for modeling and further understanding of the physical processes involved in the formation of the polar layered terrain. 2 Available data 2.1 THEMIS IR The THEMIS IR camera has 10 bands from 6 to 15 μ m. Due to signal-to-noise restrictions the most useful band for polar observations is band 9 (12.57 μ m). Band 10 (14.88 μ m) data can be used for atmospheric calibration. An example of seasonal evolution observed by the THEMIS IR subsystem is shown in Figure 1. We have projected all IR images, covering a small area near 86N and 90E into a polar stereographic projection and then sampled time dimension in order to look at temperature evolution over the course of the summer. We are plotting averaged temperature data over two 1km² regions of interest: layered material inside the trough and the surface of the residual ice cap. High resolution THEMIS IR data allows us to distinguish properties of bulk of layered

terrain and ice. We were not able yet to distinguish properties of individual layers.

Derived from text

Polar Caps; Laser Altimeters; Mars Surface; Morphology

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Geological History of Water on Mars

Baker, V. R.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Copyright; Avail: CASI; **C01**, CD-ROM; **A01**, Hardcopy; Available on CD-ROM as part of the entire parent document

While it has long been obvious from geomorphological evidence that Mars, like Earth, is a water-rich planet, this fact has proven difficult to reconcile with various aspects of Martian geochemistry and geophysics. Indeed, theorization about water on Mars has been highly controversial, with various atmospheric models for early Mars proposing: (a) warm, wet conditions generated by an intense CO₂ greenhouse, (b) denial that such a greenhouse is possible, so that geothermal heat is necessary to produce temporary water flow for valley formation, and (c) that high impact rates early in Mars history explain the release of water for valley formation. There has even been speculation that Martian landforms can be explained without any role for water at all. This debate is made particularly interesting by the stunning confirmation of large quantities of nearsurface water (ice) on Mars and the documentation of many water-related Martian landforms that are exceptionally young in age. This document profiles the Mars Is continuously Dead and Dry, Except during the Noachian (MIDDEN) and Mars Episodic Glacial Atmospheric Oceanic Upwelling by Thermotectonic Flood Outburst (MEGAOUTFLO) hypotheses.

Author

Planetary Geology; Mars Surface; Water Flow; Water; Geomorphology

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Martian Global Surface Mineralogy from the Thermal Emission Spectrometer: Surface Emissivity, Mineral Map, and Spectral Endmember Data Products

Bandfield, J. L.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; **C01**, CD-ROM; **A01**, Hardcopy; Available on CD-ROM as part of the entire parent document

One of the primary goals of the Thermal Emission Spectrometer experiment on the Mars Global Surveyor is to determine the mineralogy of the Martian surface. This information has been used to place constraints on the range of igneous processes present. The extent of water related processes on Mars has been significantly constrained by the TES experiment. The mineralogy of the Martian dust has also been refined using TES data. These mineralogical results have made a significant contribution towards determining the development of Mars, complimenting other datasets and existing information. Mineralogical determination requires the isolation of surface emissivity from the measured radiance and a variety of techniques have been developed for this purpose. Additionally, deconvolution techniques have been developed and extensively tested to separate the individual mineral contributions to the surface emissivity. These methods and techniques have produced a variety of data products that are currently available through <http://tes.asu.edu/>

Author

Planetary Geology; Mars Surface; Mineralogy; Thermal Emission; Spectrometers; Planetary Composition

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An Autonomous Instrument Package for Providing 'Pathfinder' Network Measurements on the Surface of Mars

Banerdt, W. B.; Lognonne, Ph.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Copyright; Avail: CASI; **C01**, CD-ROM; **A01**, Hardcopy; Available on CD-ROM as part of the entire parent document

The investigations of the interior and atmosphere of Mars have been identified as high scientific priorities in most planetary exploration strategy document since the time of Viking. Most recently, the National Academy of Sciences has recommended a long-lived Mars network mission as its second highest scientific priority for Mars (after sample return) for the purpose of performing seismological investigations of the interior and studying the activity and composition of the atmosphere. Despite consistent recommendations by advisory groups, Mars network missions (MESUR, Marsnet, InterMarsnet, NetLander/MSR 05, NetLander/Premier 07, NetLander/?? 09) have undergone a strikingly consistent 'Phoenix' cycle of death and rebirth over the past 15 years, and there are still no confirmed plans to address the interior and atmosphere of Mars. The latest attempt is the NetLander mission. The objective of NetLander is to place a network of four landers on Mars to perform detailed measurements of the seismicity and atmospheric pressure, temperature, wind, humidity, and opacity (as well as provide images, subsurface radar sounding profiles, and electric/magnetic field measurements). However, this mission

has recently encountered major programmatic difficulties within CNES and NASA. NASA has already cancelled its participation and the mission itself is facing imminent cancellation if CNES cannot solve programmatic issues associated with launching the mission in 2009. In this presentation we will describe an approach that could move us closer to realizing the goals of a Mars network mission and will secure at least one geophysical and meteorological observatory in 2009.

Author

Planetary Structure; Planetary Geology; Mars Missions; Networks; Mars Surface; Instrument Packages; Planetary Meteorology

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Revision of the ‘Catalog of Large Martian Impact Craters’

Barlow, N. G.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Catalog of Large Martian Impact Craters (henceforth called Catalog 1.0) was produced between 1982 and 1986 using the hard-copy versions of the Viking 1:2,000,000 photomosaics. Catalog 1.0 contains information on 42,283 impact craters ≥ 5 -km-diameter distributed globally across the planet. Each entry contains the crater's location (MC Subquadrangle, latitude and longitude of crater center), size (diameter and, if crater is elliptical, its minor diameter and azimuthal angle of orientation), terrain unit on which it is superposed, general preservational class (retains ejecta, no ejecta but crater is moderately degraded, and ghost crater), ejecta and interior morphologies (if applicable), central pit diameter (if applicable), and any comments (such as crater name). Catalog 1.0 has become one of the primary resources of crater data for Mars. Studies utilizing data from the Catalog range from crater statistical studies [1] and analysis of whether elliptical craters are anomalously frequent on Mars [2] to studies of subsurface volatile reservoirs [3]. Although not currently available on-line, the database has been distributed to all who have requested a copy. The Mars Crater Morphology Consortium has selected the Catalog of Large Martian Impact Craters to be the foundational dataset for their GIS-based integrated crater inventory [4]. However, data being acquired by the Mars Global Surveyor (MGS) and Mars Odyssey (MO) missions have revealed new insights into martian impact crater morphologies and morphometries. The Catalog of Large Martian Impact Craters is being revised to incorporate the new information from MGS's Mars Orbiter Camera (MOC), Mars Orbiter Laser Altimeter (MOLA), and Thermal Emission Spectrometer (TES) and MO's Thermal Emission Imaging System (THEMIS).

Author

Mars Craters; Catalogs (Publications); Ejecta

20030066739 Oregon State Univ., Corvallis, OR, USA

Mars Weather Systems and Maps: FFSM Analyses of MGS TES Temperature Data

Barnes, J. R.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Martian atmosphere is a highly dynamic environment, characterized by major changes on a daily basis. Transient baroclinic eddies contribute greatly to this variability the weather as do thermal tides, and smaller-scale circulations. The MGS TES atmospheric temperature data now permit the daily variability of Martian weather to be seen, globally, for the first time. Fast Fourier Synoptic Mapping (FFSM) is an analysis method that allows synoptic maps to be constructed from the highly asynoptic TES data. FFSM preserves the full space-time resolution of the data, without distorting or smoothing higher frequency phenomena such as weather systems. During periods when both ascending and descending (2 PM and 2 AM) orbital data is available, the frequency resolution of the TES data is equivalent to two synoptic maps per sol. During periods for which either ascending or descending data are available, but not both, the resolution is only one map per sol. In any case, FFSM readily allows the generation of maps at arbitrary frequencies and times. A considerable amount of mapping orbit, nadir, TES temperature data have been subjected to FFSM analysis. A wide range of seasonal periods have been analyzed, from more than two full Mars years. The basic product is synoptic temperature maps. From these maps, the geopotential height field can be estimated, along with the horizontal winds. The combination of these products constitute Mars weather maps, which allow the very dynamic nature of the atmosphere to be depicted.

Author

Mars Atmosphere; Meteorological Charts; Synoptic Meteorology; Atmospheric Temperature; Temperature Distribution

20030066740 Indiana Univ., Bloomington, IN, USA

Can Hydrous Minerals Account for the Observed Mid-Latitude Water on Mars?

Bish, D. L.; Vaniman, D. T.; Fialips, C.; Carey, J. W.; Feldman, W. C.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Clays, zeolites, and Mg-sulfates are all phases that could potentially retain H₂O in martian regolith. The nature of the hydrogen-containing material observed in the equatorial martian regolith is of particular importance to the question of whether hydrous minerals have formed in the past on Mars. Also, whether these minerals exist in a hydrated (i.e., containing H₂O molecules in their structures) or dehydrated state is a crucial question. The purpose of this communication is to estimate the possible magnitude of the H₂O reservoir constituted by these H₂O-bearing minerals. In other words, can minerals containing H₂O and/or OH such clays, zeolites, or Mg-sulfates, reasonably be expected to account for the amounts of near-equatorial H₂O-equivalent hydrogen recently documented by Mars Odyssey?

Derived from text

Planetary Geology; Planetary Composition; Mars Surface; Minerals; Water

20030066741 Southwest Research Inst., San Antonio, TX, USA

Development of a Surface-to-Exosphere Mars Atmosphere Model

Crowley, G.; Bullock, M. A.; Freitas, C.; Chocron, Sidney; Hackert, C.; Boice, D.; Young, L.; Huebner, W.; Grinspoon, D. H.; Gladstone, R., et al.; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Understanding of the diurnal, seasonal and epochal water transport and volatile loss on Mars is of major scientific interest. Volatile loss is a cornerstone of a number of important science questions because it must be understood to help explain the current atmospheric state and the relative lack of water on the planet. A new ground-to exosphere GCM is needed which considers volatile loss processes and must include explicit ground interaction with the lower atmosphere, vertical transport of H₂O, and enough chemistry to reasonably represent the loss of H and H₂ (and heavier species) from the upper atmosphere and exosphere. Including these regions in a Mars GCM allows for the estimation of global escape fluxes for the present time, which can then be extrapolated backward in time to post-cast the atmospheric state at significantly earlier time periods with different orbital elements. We are in the process of creating a new Mars GCM that will extend from the planetary surface to altitudes of about 500km, thus coupling the lower and upper atmospheres. It will explicitly include interactions between the ground and the atmosphere, such as gas phase and dust particle exchange between the two regions, and the effects of topography. Volatile transport will be simulated over both short (daily) and geological timescales to study the water distribution and to predict the D/H ratio of the present day atmosphere, thereby helping to constrain the history of water on the planet. The new Mars GCM will include simulations of the transfer of water from the planetary regolith into the atmosphere through boundary layer processes. We will also explore the role that mesoscale dynamical processes play in lofting dust into the atmosphere. The role of the dust and clouds in the planetary heat budget will be included through the use of specific microphysical and radiative transfer modules. The Mars ionosphere will be simulated with a detailed suite of chemical reactions, and over the long-term, the evolution of the D/H ratio will be predicted.

Author

Mars Atmosphere; Atmospheric General Circulation Models; Water Loss; Atmospheric Circulation

20030066742 NASA Langley Research Center, Hampton, VA, USA

A New Time-dependent Model for the Martian Radiation Environment

DeAngelis, G.; Cloudsley, M. S.; Singleterry, R. C., Jr.; Wilson, J. W.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations

Contract(s)/Grant(s): NCC1-404; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Manned space activities have been until present time limited to the near-Earth environment, most of them to low Earth orbit (LEO) scenarios, with only some of the Apollo missions targeted to the Moon. In current times most human exploration and development of space (HEDS) activities are related to the development of the International Space Station (ISS), and therefore take place in the LEO environment. A natural extension of HEDS activities will be going beyond LEO, and reach asteroids, Mars, Jupiter, Saturn, the Kuiper belt and the outskirts of the Solar System. Such long journeys onboard spacecraft outside the protective umbrella of the geomagnetic field will require higher levels of protection from the radiation environment found in the deep space for both astronauts and equipment. So, it is important to have available a tool for radiation shielding

which takes into account the radiation environments found all along the interplanetary space and at the different bodies encountered in the Solar System. Moreover, the radiation protection is one of the two NASA highest concerns and priorities. A tool integrating different radiation environments with shielding computation techniques especially tailored for deep space mission scenario is instrumental in view of this exigency. In view of manned missions targeted to Mars, for which radiation exposure is one of the greatest problems and challenges to be tackled, it is of fundamental importance to have available a tool which allows to know which are the particle flux and spectra at any time at any point of the Martian surface. With this goal in mind, a new model for the radiation environment to be found on the planet Mars due to Galactic Cosmic Rays (GCR) has been developed. Solar modulated primary particles rescaled for Mars conditions are transported within the Martian atmosphere, with temporal properties modeled with variable timescales, down to the surface, with altitude and backscattering patterns taken into account. The tool allows analysis for manned Mars landing missions, as well as planetary science studies, e.g. subsurface water and volatile inventory studies. This Mars environmental model is available through the SIREST website, a project of NASA Langley Research Center.

Author

Manned Mars Missions; Environment Models; Mars Environment; Radiation Dosage; Radiation Protection

20030066743 Max-Planck-Inst. fuer Chemie, Mainz, Germany

Evolution of the Martian Crust as Derived from Surface Measurements by Mars Odyssey, Other Space Missions, and Martian Meteorites

Dreibus, G.; Brueckner, J.; Boynton, W. V.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The large-crater covered Martian crust and the absence of large scale recycling suggests strongly that the crust was a product of an ancient planetary global differentiation process about 4.5 Ga as indicated by the whole rock Rb-Sr isotopic compositions of the Martian meteorites. Together with geophysical and geochemical data from spacecraft missions, the Martian meteorites provide constraints on the nature of the crust. Using elemental data from orbital and in-situ measurements of the Martian surface and Martian meteorites, an estimation of the global Martian crust composition could be derived. There are two distinctively different methods to obtain elemental composition of the surface: either by remote sensing or in-situ measurements. Both are complimentary to each other.

Derived from text

Evolution (Development); Planetary Geology; Planetary Crusts; Mars Surface

20030066744 Nevada Univ., Reno, NV, USA

Spectral and Chemical Characteristics of Lake Superior Banded Iron Formation: Analog for Martian Hematite Outcrops

Fallacaro, Alicia; Calvin, Wendy; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Lake Superior iron formation serves as an analog to the gray, crystalline hematite on Mars discovered by the Thermal Emission Spectrometer (TES). Spatial analyses of the hematite sites at Sinus Meridiani, Aram Chaos, and Valles Marineris suggest that the hematite exists within a stratigraphic layer, and is of a sedimentary nature. These sites are not associated with volcanic activity due to the lack of volcanic features such as lava flows and fissures. One of the formation mechanisms for crystalline, gray hematite is through precipitation of ferric oxides in Fe-rich waters as in terrestrial banded iron formation (BIF). Increased hydration signatures in Mariner 6 and 7 data of the Meridiani and Aram Chaos sites also supports an aqueous formation mechanism. Subsequent burial metamorphism would crystallize the deposit.

Derived from text

Lake Superior; Mars Surface; Metamorphism (Geology); Spectra; Spectrum Analysis

20030066745 Space Science Inst., Boulder, CO, USA

THEMIS Observations of Pitted Cones in Acidalia Planitia and Cydonia Mensae

Farrand, W. H.; Gaddis, L. R.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations

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Analysis of Viking imagery revealed the presence of large numbers of pitted or cratered cones in the northern plains of Mars with the highest concentrations occurring in eastern Acidalia Planitia and Cydonia Mensae. Based largely on crater/cone diameter ratio comparisons, these features were hypothesized as being analogous to terrestrial pseudocraters (rootless cones) such as occur in the Lake Myvatn region of Iceland. Doubts remained about this connection given the disparity in mean diameters between these Martian features (mean diameter of approx. 600 m) and the Icelandic rootless cones (mean diameter of approx. 50 m). Recent analysis of MOC Narrow Angle camera images of Elysium Planitia, Amazonis Planitia and elsewhere have revealed another class of features with diameters commensurate with the Icelandic rootless cones. If the features in Acidalia and Cydonia are not rootless cones, what are they? Recent information on the thermophysical properties of these features as provided by the Mars Odyssey THEMIS instrument may help to answer this question.

Derived from text

Mars Surface; Mars Craters; Volcanoes; Thermophysical Properties

20030066747 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Berlin, Germany

A New Model on the Thermal Behavior of the Near Surface Layer on Mars and Its Implications for Ground Ice Deposits in Gusev Crater

Helbert, J.; Benkhoff, J.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations

Contract(s)/Grant(s): BE-1630/2; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

For this study we have assumed a 50m thick surface layer composed of an initially homogeneous, porous, crystalline ice rock-dust mixture. This layer contains dust, rocks and two components of chemically different ices (H₂O, CO₂). We have used lower lateral resolution of only 10cm. The model solves the time-dependent mass and energy equations for the different volatiles simultaneously. Solar energy input varies due to orbital and rotational motion of the planet. Heat is transferred into the interior of the body by solid state heat conduction in the dust-rock-ice mixture (matrix) and by vapor flowing through the porous matrix. The gas flow from the sublimation fronts is driven by vapor pressure gradients. A dust layer (crust) on the surface is assumed in which all the volatiles are vaporized. The crust is initially very thin (one layer) and can grow because of inward migration of the sublimation fronts. The energy conservation equation for the porous, icy, dusty layer is included in the model.

Derived from text

Ice; Mathematical Models; Surface Layers; Mars Surface; Mars Craters; Thermophysical Properties

20030066748 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Characterizing the Oxidizing Properties of Mars' Polar Regions

Hendrix, A. R.; Simmons, K. E.; Mankoff, K. D.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

We investigate the oxidizing properties of Mars polar regions using disk-resolved ultraviolet spectra from the Ultraviolet Spectrometer (UVS) on Mariner 9. We detect the spectral characteristic of hydrogen peroxide (H₂O₂), which has already been found to exist on the icy galilean satellites. The Mariner 9 UVS data have been archived at NASA's Planetary Data System (PDS) Atmospheric Node and are also available at http://lasp.colorado.edu/Mariner_9_data/. A software visualization tool, Albatross, provides database access (<http://lasp.colorado.edu/albatross/>) and enables the user to view reflectance spectra for desired latitude/longitude regions and mission phases. It displays the UVS field-of-view (FOV) tracks along with the corresponding reflectance spectrum for a chosen FOV against a background showing the Mars surface image, or a user specified alternate dataset, such as a thermal, geologic or topographic map.

Derived from text

Mars Surface; Oxidation; Polar Regions; Ultraviolet Spectra; Planetary Mapping

20030066749 Geological Survey, Flagstaff, AZ, USA

The Imager for Mars Pathfinder Insurance Pan

Herkenhoff, K. E.; Johnson, J. R.; Weller, L. A.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Imager for Mars Pathfinder (IMP) obtained a full panorama of the Sagan Memorial Station landing site on Sol 2,

before the IMP mast was deployed. The images in this panorama were taken in 4 filters (including stereo) and losslessly compressed to provide a high-quality multispectral survey of the landing site even if the IMP mast did not successfully deploy; this data set was therefore called the Insurance Pan. It was completed late in the afternoon of Sol 2, just before the IMP mast was (successfully) deployed. The data were stored in memory and returned to Earth after it became clear that downlink rates were higher than expected. The Insurance Pan horizontal (azimuth) coverage is nearly complete, with gaps caused by pointing errors and data packet losses. Stereo data were acquired in the blue (445 nm) filter, as well as right-eye green (531 nm), orange (600 nm), and near-infrared (752 nm) data.

Derived from text

Mars Pathfinder; Panoramic Cameras; Image Processing; Mars Surface

20030066750 Brown Univ., Providence, RI, USA

Geology of the Syrtis Major/Isidis Region of Mars: New Results from MOLA, MOC, and THEMIS

Hiesinger, H.; Head, J. W., III; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The motivation of our study is to characterize the Isidis basin in terms of topography and morphology, to investigate the origin of its geologic units, to study the geologic history and evolution of the basin, and to provide additional geologic context for the Beagle lander. The Isidis basin is important in that it is one of the major impact basins on Mars. Although not part of the northern lowlands, it contains deposits of the Vastitas Borealis Formation. Syrtis Major is a large volcanic complex immediately west of the Isidis basin and it has been observed that lavas from Syrtis Major and deposits in the Isidis basin (i.e. the Vastitas Borealis Formation) have complex stratigraphic relationships [Ivanov and Head, 2002, 2003]. We report on results of our investigation of this region based on topographic and imaging data obtained by orbiting spacecraft such as Mars Global Surveyor (MGS) and Mars Odyssey. This study complements our recently completed analyses of Syrtis Major [Hiesinger and Head, 2003] and the transition between Syrtis Major and Isidis [Ivanov and Head, 2003]. The new data allow one to get a detailed view of the Isidis basin, its structure, stratigraphy, geologic history, evolution and its relationship to the Syrtis Major volcanic complex. We will address a number of scientific questions, for example, what are the characteristics of the Isidis rim and what caused its present morphology? What role does Syrtis Major play in the evolution of the Isidis rim? What is the role and fate of volatiles in the Isidis basin and what are the characteristics of the uppermost surface layer? Does the floor of the Isidis basin primarily consist of volcanic plains as indicated by wrinkle ridges and cone-like features, material deposited by a catastrophic collapse of the rim as proposed by Tanaka et al. [2000], or of sediments deposited in an ocean as suggested by Parker et al. [1989, 1993]? What is the stratigraphy of the deposits within the Isidis basin and what processes were responsible for its present appearance? Finally, what is the origin of the thumbprint terrain exposed within the inner basin?

Derived from text

Mars Surface; Paleontology; Structural Basins; Planetary Geology; Stratigraphy

20030066751 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

The Athena Microscopic Imager Investigation

Herkenhoff, K. E.; Aquyres, S. W.; Bell, J. F., III; Maki, J. N.; Arneson, H. M.; Brown, D. I.; Collins, S. A.; Dingizian, A.; Elliot, S. T.; Geotz, W., et al.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Athena science payload on the Mars Exploration Rovers (MER) includes the Microscopic Imager (MI) [1]. The MI is a fixed-focus camera mounted on the end of an extendable instrument arm, the Instrument Deployment Device (IDD; see Figure 1). The MI was designed to acquire images at a spatial resolution of 30 microns/pixel over a broad spectral range (400 - 700 nm; see Table 1). Technically, the microscopic imager is not a microscope: it has a fixed magnification of 0.4 and is intended to produce images that simulate a geologist's view through a common hand lens. In photographers parlance, the system makes use of a macro lens. The MI uses the same electronics design as the other MER cameras [2, 3] but has optics that yield a field of view of 31° across a 1024 × 1024 pixel CCD image (Figure 2). The MI acquires images using only solar or skylight illumination of the target surface. A contact sensor is used to place the MI slightly closer to the target surface than its best focus distance (about 66 mm), allowing concave surfaces to be imaged in good focus. Because the MI has a relatively small depth of field (3 mm), a single MI image of a rough surface will contain both focused and unfocused areas. Coarse focusing will be achieved by moving the IDD away from a rock target after the contact sensor is activated. Multiple images taken at various distances will be acquired to ensure good focus on all parts of rough surfaces. By combining a set of images acquired in this way, a completely focused image can be assembled. Stereoscopic observations can be obtained by

moving the MI laterally relative to its boresight. Estimates of the position and orientation of the MI for each acquired image will be stored in the rover computer and returned to Earth with the image data. The MI optics will be protected from the Martian environment by a retractable dust cover. The dust cover includes a Kapton window that is tinted orange to restrict the spectral bandpass to 500-700 nm, allowing color information to be obtained by taking images with the dust cover open and closed. The MI will image the same materials measured by other Athena instruments (including surfaces prepared by the Rock Abrasion Tool), as well as rock and soil targets of opportunity. Subsets of the full image array can be selected and/or pixels can be binned to reduce data volume. Image compression will be used to maximize the information contained in the data returned to Earth. The resulting MI data will place other MER instrument data in context and aid in petrologic and geologic interpretations of rocks and soils on Mars.

Author

Mars Exploration; Spatial Resolution; Cameras; Images

20030066752

The Ice Towers of Mt. Erebus as Analogues of Biological Refuges on Mars

Hoffman, N.; Kyle, P. R.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The past three years have seen an explosion of speculation about flow features on modern Mars, based on physical evidence including the Malin and Edgett gullies and dark dust streaks. In parallel, supporting work has shown that liquid water is temporarily stable on the surface of Mars for the necessary period of minutes to hours to form these features. Although alternative non-aqueous models have been proposed, a majority of authors prefer a model of ephemeral liquid water to explain the features - especially the gullies, for which Arctic analogues exist. Nonetheless, what is lacking in the studies to date is an appreciation of how water will behave under arid and cryogenic conditions, when it is close to the triple point. Under these circumstances, water will vaporize easily and large amounts of transport can take place in the vapor phase. In this contribution we draw attention to Mount Erebus, on Ross Island, Antarctica, where unusual volcanic fumaroles form hollow icy towers, under conditions that are almost as cold and dry as Mars. We suggest that the search for active liquid water on present-day Mars can be targeted at these towers which have obvious thermal and albedo anomalies, and a characteristic surface expression and pattern of occurrence. Under the harsh surface conditions of Mars, these icy fumarole towers represent a warm environment with high water vapor saturation and partial UV shielding perhaps the most benign surface environment imaginable on modern-day Mars. Unfortunately, the analogue environment on Earth does not contain significant occurrences of liquid water, but the concept is nonetheless significantly attractive in the search for bioactivity on Mars. We illustrate this search by an example from Hellas Basin that appears to represent a chain of geothermal anomalies or hot spots. These are elevated by some 20-40K above the ambient temperature, based on Themis IR data, and should be checked with high-resolution visible imagery to look for the characteristic albedo signature of ice towers. Nearby, two extended patches of thermal anomaly are also of interest and could represent surface escape of fluids and vapor. The search for additional sites is continuing.

Derived from text

Albedo; Anomalies; Geothermal Anomalies; Ice; Mars Surface; Planetary Geology; Mars Volcanoes

20030066753 Bay Area Environmental Research Inst., Sonoma, CA, USA

Towards a Martian Weather Service

Houben, H.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Experience from MGS shows that an orbital sounder taking nadir and limb measurements can constrain the global Martian meteorology on a daily basis. Mutually consistent retrievals of all significant atmospheric variables can be obtained and can be calibrated or validated against independent measurements using data assimilation techniques. But this can be an arduous process. The low level data products (e.g., calibrated infrared radiances) required as input to the assimilation process are not immediately available and, as a result, it is not yet possible to produce timely analyses and forecasts of Martian weather by these techniques. The growing number of current and future instruments that will contribute to our knowledge of the Mars atmospheric system in addition to the Thermal Emission Spectrometer which is the major atmospheric instrument in orbit around Mars at this time, there are radio occultations and Horizon Sensor infrared measurements from MGS, broadband (but high spatial resolution) observations from MO THEMIS, and Mars Express will provide infrared and UV data from PFS and SPICAM makes the problem of collecting all the relevant data even more difficult. Nevertheless, there are many scientific and operational reasons why a new approach targeted at producing realtime weather products is desirable for Mars: to guide

scientific observations of rapidly varying phenomena (like dust storms on many scales); to implement adaptive observations that will improve the scientific return from spacecraft missions; to assist in aerobraking or aerocapture operations; to facilitate exploration by gliders, balloons, and aircraft; to warn surface explorers of dust storms; to assure the intercomparability of different instrument datasets; etc. In addition, the ready availability of such products is bound to inspire a host of new investigations by scientists and laymen. This paper describes the current state of the art in Martian weather analysis and forecasting and steps that will make it possible to produce realtime high level meteorological data products (i.e., four dimensional wind, temperature, geopotential, and tracer fields) in the near future.

Derived from text

Mars Atmosphere; Meteorological Parameters; Weather Forecasting; Planetary Meteorology

20030066754 Toledo Univ., OH, USA

Seasonal Variation of Martian Polar Caps: 1999 and 2001 MOC Data

James, P. B.; Benson, J. L.; Cantor, B. A.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations

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The seasonal Martian polar caps wax and wane in response to condensation and sublimation of carbon dioxide resulting from seasonal insolation changes on Mars. Numerous data exist on observations of the recession or sublimation phases in the visible portion of the spectrum for the last two centuries. William Herschel published the first quantitative observations of the seasonal recession of the Martian polar caps in 1784. During the next 180 years, ground based observers used a variety of techniques to observe recessions; Slipher summarized these observations in 1962, on the eve of the first space exploration of Mars. Portions of the seasonal cycles of the surface caps that were observed by Mariners 7 and 9 and by Viking as well as ground based studies from 1971-1988 by the International Planetary Patrol were summarized in a review article following the Fourth International Conference on Mars in 1989. Hubble Space Telescope observed points in the seasonal recessions of the south and north caps during the 1990 s. Differences between different Martian regressions have been reported in the past; but, because many of the relevant data sets are localized in longitude, at least some of these results could be an artifact introduced by the considerable longitudinal asymmetry that observed during recessions.

Derived from text

Annual Variations; Mars Surface; Carbon Dioxide

20030066755 Geological Survey, Flagstaff, AZ, USA

Two-Layer Visible/Near-Infrared Radiative Transfer Modeling Using Bloomsburg University Goniometer (BUG) Observations of Dust-coated Rocks

Johnson, J. R.; Grundy, W. M.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The masking effects of windblown and airfall-deposited dust (i.e., less than 40 μ m particles) on underlying rocks and soils hinders interpretations of reflectance spectra of the surface obtained from orbit and from the Viking and Mars Pathfinder landers. Dust coatings also hampered analyses of alpha proton x-ray (APXS) measurements of rocks and decreased Mars Pathfinder lander and rover solar panel power. Laboratory investigations of the spectral effects of dust and rock coatings demonstrated that thin (less than 100 μ m) layers of such coatings can effectively mask the spectral signature of the underlying materials in the visible and infrared. To study the effects of dust deposition quantitatively, we are investigating visible/near-infrared reflectance of palagonitic dust coatings on substrates of basaltic andesite as functions of illumination and emission angles using the Bloomsburg University Goniometer (BUG). Analysis of the bidirectional reflectance distribution function (BRDF) of the Mars regolith simulant JSC-1 palagonite deposited onto such substrates at a variety of coating thicknesses and at multiple visible/near-infrared wavelengths provides critical information for interpreting the photometric properties of the Martian surface.

Derived from text

Atmospheric Boundary Layer; Near Infrared Radiation; Mars Surface; Radiative Transfer

20030066756 Eotvos Lorand Univ., Budapest, Hungary

Isidis, Argyre and Hellas: Subsurface Indicators of Climate Changes

Kereszturi, A.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Mars Express and Beagle-2 lander gives possibility for detailed orbital analysis of the subsurface ice at the great basins with GPR, and in-situ analysis at the Early-Noachian aged Isidis Planitia. In this work we summarize implications for the subsurface ice distribution and one possibility to use it as indicator of the last great climate change. This could hold information on planetary evolution.

Derived from text

Climate Change; Mars Surface; Ice

20030066759 NASA Johnson Space Center, Houston, TX, USA

Analysis of Moessbauer Data from Mars: A Database and Artificial Neural Network for Identification of Iron-bearing Phases

Morris, R. V.; deSouza, P. A.; Morris, R. V.; Klingelhofer, G.; Sixth International Conference on Mars; July 2003; 2 pp.; In English; See also 20030066530; Original contains color illustrations

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The exploration of the planet Mars is one of the major goals within the Solar system exploration programs of the US-American space agency NASA and the European Space Agency ESA. In particular the search for water and life and understanding of the history of the surface and atmosphere will be the major tasks of the upcoming space missions to Mars. The miniaturized Moessbauer spectrometer MIMOS II has been selected for the NASA Mars-Exploration-Rover twin-mission to Mars in 2003 and the ESA 2003 Mars-Express Beagle 2 mission. Reduced in size and weight, in comparison to ordinary laboratory setup, the sensor head just weights approximately 400 g, with a volume of (50x50x90) cu mm, and holds two gamma-ray sources: the stronger for experiments and the weaker for calibrations. The collimator (in sample direction) also shields the primary radiation off the detectors. Around the drive four detectors are mounted. The detectors are made of Si-PIN-photodiodes in chip form (100 sq mm, thickness of 0.5 mm). The control unit is located in a separate electronics board. This board is responsible for the power supply, generation of the drive's velocity reference signal, read of the detector pulses to record the spectrum, data storage and communication with the host computer. After more than four decades from the discovery of the Moessbauer effect, more than 400 minerals were studied at different temperatures. Their Moessbauer parameters were reported in the literature, and have been recently collected in a data bank. Previous Mars-missions, namely Viking and Mars Pathfinder, revealed Si, Al, Fe, Mg, Ca, K, Ti, S and Cl to be the major constituents in soil and rock elemental composition of the red planet. More than 200 minerals already studied by Moessbauer spectroscopy contain significant amounts of these elements. A considerable number of Moessbauer studies were also carried out on meteorites and on Moon samples. Looking backward in the studies of the whole Moessbauer community, we have built a specific library containing Moessbauer parameters of those possible Mars minerals. The selected minerals, their Moessbauer parameter values (min. max. s.d and number of available data), main site substitution, behavior as a function of temperature and a ranking as expected to be found on Mars were organized. Mars-analogue Fe-bearing minerals not studied by Moessbauer spectroscopy are being collected and investigated. In addition, it an identification system based on Artificial Neural Networks (ANN) was implemented which enables fast and precise mineral identification from the experimental Moessbauer parameters at a given temperature.

Author

Moessbauer Effect; Mars Missions; Planetary Composition; Chemical Analysis; Data Bases; Neural Nets

20030066760 Chicago Univ., Chicago, IL, USA

The Chemical Composition of Martian Samples: Final Results from the Pathfinder Alpha Proton X-Ray Spectrometer

Economou, T. E.; Foley, C. N.; Clayton, R. N.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Alpha Proton X-ray Spectrometer (APXS) on the Pathfinder mission to Ares Vallis on Mars in July, 1997, provided data that were used to determine the geochemistry and infer the petrology of the rocks and soils at the landing site. The previously reported preliminary X-ray results were based on calibration data before instrumental biases were determined and before a minor instrumental difference between the laboratory and flight instrument was corrected. Also, these preliminary results did not include alpha and proton results. The alpha mode in particular reveals the amounts of carbon and oxygen, important for understanding of the volatile contents of the Pathfinder samples. In order to determine the abundances from the alpha proton modes, a technique for atmosphere subtraction from the spectra was developed. The flight duplicate has been used to determine the accuracy of analysis under Martian conditions with all three modes of the APXS. We have now finished the re-analysis of all the Pathfinder APXS data, both the alpha proton and the x-ray modes. Two papers, one on the calibration

of the APXS and another one on the final results of the martian samples at the Pathfinder landing site, have been written and sent for publication to JGR. This work was also the basis for a Ph.D. degree awarded at the University of Chicago.

Author

X Ray Spectrometers; Protons; Planetary Composition; Chemical Analysis; Mars Surface Samples; Alpha Particles

20030066761 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Pressure Balance at Mars and Solar Wind Interaction with the Martian Atmosphere

Krymskii, A. M.; Ness, N. F.; Crider, D. H.; Breus, T. K.; Acuna, M. H.; Hinson, D.; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The strongest crustal fields are located in certain regions in the Southern hemisphere. In the Northern hemisphere, the crustal fields are rather weak and usually do not prevent direct interaction between the SW and the Martian ionosphere/atmosphere. Exceptions occur in the isolated mini-magnetospheres formed by the crustal anomalies. Electron density profiles of the ionosphere of Mars derived from radio occultation data obtained by the Radio Science Mars Global Surveyor (MGS) experiment have been compared with the crustal magnetic fields measured by the MGS Magnetometer/Electron Reflectometer (MAG/ER) experiment. A study of 523 electron density profiles obtained at latitudes from +67 deg. to +77 deg. has been conducted. The effective scale-height of the electron density for two altitude ranges, 145-165 km and 165-185 km, and the effective scale-height of the neutral atmosphere density in the vicinity of the ionization peak have been derived for each of the profiles studied. For the regions outside of the potential mini-magnetospheres, the thermal pressure of the ionospheric plasma for the altitude range 145-185 km has been estimated. In the high latitude ionosphere at Mars, the total pressure at altitudes 160 and 180 km has been mapped. The solar wind interaction with the ionosphere of Mars and origin of the sharp drop of the electron density at the altitudes 200-210 km will be discussed.

Derived from text

Wind (Meteorology); Solar Wind; Mars Atmosphere; Magnetic Fields; Atmospheric Density

20030066762 Planetary Science Inst., Tucson, AZ, USA

A Study of Meridiani Planum, Mars, Using THEMIS Data

Lane, Melissa D.; Christensen, Phillip R.; Hartmann, William K.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Recently two landing sites were selected for the upcoming Mars Exploration Rover (MER) missions that will be sent to the surface of Mars in the summer of 2003 and will land in early 2004. The chosen locations are Gusev Crater and Meridiani Planum. This work will focus on characterizing the Meridiani Planum landing site region using data from the Thermal Emission Imaging System (THEMIS) instrument aboard the currently orbiting Mars Odyssey spacecraft. The Meridiani Planum region of Mars is known to host gray, possibly platy, hematite in occurrence with basalt. The THEMIS instrument operates in both the VIS and thermal IR wavelengths as a push-broom, multispectral imager. THEMIS hosts 5 VIS bands and 10 IR bands. THEMIS is a spacecraft-mounted, nadir-looking instrument whose IR and VIS camera focal planes have 320 and 1024 across-track picture elements (pixels), respectively. For additional details regarding the instrument characterization see. This study utilizes single-band images from the visible (VIS), daytime infrared (IR), and nighttime IR data for crater population analyses and also multi-band daytime IR data for compositional analyses.

Derived from text

Craters; Data Processing; Landing Sites; Mars Exploration; Mars Surface

20030066763 Los Alamos National Lab., NM, USA

In Situ Neutron Spectroscopy on the Martian Surface: Modeling the HYDRA Instrument for Different Mission Scenarios

Lawrence, D. J.; Elphic, R. C.; Feldman, W. C.; Moore, K. R.; Prettyman, T. H.; Wiens, R. C.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Planetary neutron spectroscopy has proven to be highly successful in remotely detecting and measuring the abundance of water on planetary surfaces such as Mars and the Moon. Because of the central role played by water on Mars and the need to make in situ measurements of water abundances for landed missions, neutron spectroscopy is also being investigated as a technique for quickly determining the near-surface water abundance for future Mars missions, such as the Mars Smart Lander

(MSL). We are currently developing a water- and hydrate-sensing instrument called HYDRA that is being supported by the NASA Mars Instrument Development Program (MIDP). Previous work has been supported by the NASA Planetary Instrument Design and Development (PIDDP) Program. A detailed description of the science justifications for the HYDRA instrument are given as a companion paper in this conference [5]. Here we focus on summarizing results of modeling work that demonstrates surface based neutron spectroscopy is indeed feasible and can be successfully carried for a wide variety of mission scenarios. In particular, we have investigated: 1) the effects of mounting a neutron spectrometer (NS) on the body of a rover and/or lander; and 2) the effects of making neutron measurements in the presence of a radioactive thermal generator (RTG) that produces copious amounts of neutrons. In both of these situations, we have determined that robust measurements of water content can be made using the technique of neutron spectroscopy.

Derived from text

In Situ Measurement; Spectroscopy; Mars Surface; Models; Hydrodynamics

20030066764 Washington Univ., Seattle, WA, USA

Wind and Water at the Surface of Mars

Leovy, C. B.; Armstrong, J. C.; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

It is widely assumed that the surface of Mars has been exposed to massive flows of liquid water. These flows are supposed to have taken place both near the end of the early intense bombardment period under a warm wet climate regime and in massive outburst floods, mainly around the periphery of large low latitude volcanic complexes such as Tharsis. However, these scenarios do not adequately account for several lines of evidence that point toward a smaller role for flowing water and a larger role for wind in surface modification. With the aim of broadening the terms of discussion of martian surface history, these lines of evidence are reviewed and interpreted here.

Derived from text

Water; Wind (Meteorology); Mars Surface

20030066766 NASA Goddard Space Flight Center, Greenbelt, MD, USA

4-D Model of CO₂ Deposition at North and South of Mars from HEND/Odyssey and MOLA/MGS

Litvak, M. L.; Mitrofanov, I. G.; Kozyrev, A. S.; Sanin, A. B.; Tretyakov, V.; Smith, D. E.; Zuber, M. T.; Boynton, W. V.; Hamara, D. K.; Shinohara, C., et al.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The first 1.5 year of neutron mapping measurements onboard Mars Odyssey spacecraft are presented based on High Energy Neutron Detector (HEND) observations. HEND instrument is a part of GRS suite responsible for registration of epithermal and fast neutrons originating in Mars subsurface layer. The scattering of fast neutrons in Mars surface caused by primary cosmic rays is strongly sensitive to presence of hydrogen atoms. Even several percents of subsurface water significantly depress epithermal and fast neutron flux. It turns orbit neutron spectroscopy into one of most efficient methods for finding distribution of subsurface water. The Mars Odyssey observations revealed huge water- ice regions above 60N and 60S latitudes. It was founded that distribution of subsurface water has layered structure at these regions. It is thought that more than 50% wt water ice covered by relatively dry layer with different thickness.

Derived from text

Carbon Dioxide; Models; Deposition; Spectroscopy; Planetary Mapping; Mars Surface; Mode

20030066767 Malin Space Science Systems, San Diego, CA, USA

Layered Outcrops on Mars

Malin, Michael C.; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Layered and massive outcrops on Mars, some as thick as 4 km, display the geomorphic attributes and stratigraphic relations of sedimentary rock. Sequences in some locations imply a dynamic depositional environment during early martian history. Subaerial (such as aeolian, impact, and volcani-clastic) and subaqueous processes may have contributed to the formation of the layers. Affinity for impact craters suggests cominance of lacustrine deposition, alternatively, the materials were deposited in a dry, subaerial setting in which atmospheric variations mimicked a subaqueous depositional environment.

The source regions and transport paths for the materials are not preserved.

Author

Craters; Deposition; Geomorphology; Mars (Planet); Sedimentary Rocks

20030066768 Centre National de la Recherche Scientifique, Orsay, France

Ductile Deformation in Hellas Floor: Salt Diapirs or Crustal Domes?

Mangold, N.; Allemand, P.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Periodic concentric features named honeycomb terrains are observed in the North- Western part of Hellas. These terrains cover the lowest part of the Hellas basin at elevations of 7 to 5 km, thus also the lowest points on Mars. Each honeycomb cell is about 5 to 10 km large. At MOC scale these features shows lot of deformed materials. Some authors speculate about possible ice blocks and soft muddy deformation to explain the formation of these concentric features. In this study we show that the structural analysis of MOC images favors a ductile formation by doming inside a soft medium. Structural patterns typical of ductile shear zones are also observed. We discuss if this doming better correspond to salt diapirs or lower crustal tectonism. We propose that these features could correspond to ductile deformations similar to those observed on outcrops of the lower crust of the Archean period on Earth.

Derived from text

Ductility; Deformation; Honeycomb Structures; Mars Surface; Structural Analysis

20030066769 Paris-Sud Univ., Orsay, France

Formation of Gullies on Mars: What Do We Learn from Earth?

Mangold, N.; Costard, F.; Forget, F.; Baratoux, D.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The observation of gullies on Mars indicates the presence of liquid water in recent times [1]. They have been proposed to result of subsurface seepage of water [1], geothermal activity [2] or brines [3], near-surface ice melting at recent periods of high obliquity [4], snowmelt in more recent periods [5] or liquid CO₂ breakout [6]. In this study, we describe how terrestrial studies help to understand better the formation of Martian gullies. We show that all characteristics of Martian gullies are consistent with some external process triggered by seasonal melting at high obliquity.

Author

Mars Surface; Water Erosion; Rocks

20030066770 Boston Univ., Boston, MA, USA

Tongue-shaped Lobes on Mars: Morphology, Nomenclature, and Relation to Rock Glacier Deposits

Marchant, D. R.; Head, J. W.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Recent work based upon Mars Global Surveyor (MGS) data, in conjunction with previous analyses of Viking data, suggests that rock glaciers, similar in form to those found in polar climates on Earth, have been an active erosional feature in the recent geologic history of Mars. A wide range of literature exists describing rock glacier characteristics, form, and distribution, but diversity of opinion exists on rock glacier nomenclature and genesis. In this contribution we outline the two-fold genetic classification of Benn and Evans for terrestrial rock glaciers, and then propose a non-genetic descriptive set of terms to be applied to martian features.

Derived from text

Deposits; Erosion; Glaciers; Mars Surface; Rocks

20030066771 Brown Univ., Providence, RI, USA

Erosional Morphologies and Characteristics of Latitude-dependent Surface Mantles on Mars

Milliken, R. E.; Mustard, J. F.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Latitude-dependent layered deposits and terrains on the surface of Mars were first observed in Mariner 9 images. Similar

layered deposits were later observed in higher-resolution Viking images, as well as lobate debris aprons, lineated valley fill, concentric crater fill, and terrain softening. The latter group of features were confined to the mid-latitude regions and were attributed to viscous creep of ice-rich material. In addition to these observations, recent high-resolution images acquired by the Mars Orbiter Camera (MOC) onboard the Mars Global Surveyor (MGS) mission revealed a distinct surface morphology present in the mid-latitude regions.

Derived from text

Erosion; Morphology; Mars Surface; Latitude

20030066772 Academy of Sciences (Russia), Troitsk, Russia

In Situ Measurements of the Phobos Magnetic Field During the ‘Phobos-2’ Mission

Mordovskaya, V. G.; Oraevsky, V. N.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The future explorations to Mars have to take into account the Martian satellites, Phobos and Deimos, because their substance may carry the information on an origin and evolution of Mars. The trajectory of Phobos2 provided the collection of data in regions which are appropriate for an investigation of interaction of Phobos with the solar wind and have not been explored before. From March 22, 1989, to March 26, 1989, at each orbit around Mars, both Phobos2 spacecraft and the Mars satellite Phobos were inside the solar wind and within the Martian magnetosphere during 3.8 h. The spacecraft was located permanently in a vicinity of Phobos at this time and the distances between them were 180 400 km. A sharp rise in the regular part of the magnetic field was observed on the circular orbits near the dayside of Phobos at distances of 180 250 km from its center when Phobos was in the unperturbed solar wind. The magnetization of Phobos substance is 0.15 CGS. The third part of volume of Phobos should consist of a magnetic substance similar to a magnetite Fe_3O_4 in order to obtain the given magnetization of Phobos. Since the density of Phobos is about 2 g/cm³, we can suggest two explanations for the magnetization observed. First, Phobos is nonuniform and there exists an immense piece of a magnetic material within it. Second, Phobos consists of small pieces of a magnetic substance immersed into a nonmagnetic low density material.

Author

Phobos; Magnetic Fields; Mars (Planet)

20030066773 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Re-Assessing Plains-style Volcanism on Mars

Sakimoto, S. E. H.; Gregg, T. K. P.; Hughes, S. S.; Chadwick, J.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations

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The volcanic plains of Mars have long been thought to be analogous to the Snake River Plains (SRP), Idaho, on Earth, primarily in terms of the range of low shields, fissure eruptions, and flows that coalesce to resurface large tracts of plains regions. The Tempe region of Mars was usually the most frequently cited analog prior to the Mars Global Surveyor (MGS) and Mars Odyssey (MO) missions. Since the (MGS) Mission and the availability of Mars Orbiter Laser Altimeter (MOLA) topography, it has become clear that the number of shields and vents is far greater than that estimated on the basis of prior image data alone, and that in many cases, the previously identified shields were actually only the steeper summits of far more extensive edifices with shallow lower flanks.

Derived from text

Mars Volcanoes; Mars Surface; Topography

20030066774 Harvard Univ., Cambridge, MA, USA

The Carbon Cycle, Climate Variability and the Fate of an Early Martian Ocean

Schrag, D. P.; Zuber, M. T.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The surface of Mars preserves the record of a past climate in which liquid water was stable and apparently abundant [1]. We seek to understand the planetary-scale control of climate through the study of climatic perturbations and their relationship to the carbon cycle on Earth, making basic geological and geochemical observations and then comparing these data with simple models of biogeochemical cycles. We have previously applied this approach to a range of geological situations on Earth

including the Neoproterozoic glaciations and a new theory for what causes oscillations in CO₂ and climate on approx. 100 million year time scales [4].

Author

Mars Surface; Carbon Cycle; Climatology

20030066775 American Geophysical Union, Washington, DC, USA

High Channels on Mars Indicate Hesperian Recharge at Low Latitudes

Coleman, N. M.; Dinwiddie, C. L.; Casteel, K.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

A special class of Martian outflow channels discharged from enormous fracture zones. These channels were sourced by groundwater, not surface water, and when observed on high-standing plateaus they provide paleo-indicators of climax groundwater levels. We identify two outflow channels of Hesperian age that issued from a 750-km-long fault zone extending from Candor Chasma to Ganges Chasma. One channel source stands approx. 2600 m above the datum, too high to be explained by discharge from a global aquifer. The indicated groundwater levels require regional sources of recharge and provide evidence that a high-standing, ice-covered lake probably existed in eastern Candor Chasma.

Author

Mars Surface; Ground Water; Ice; Lakes

20030066776 Los Alamos National Lab., NM, USA

Detecting Near-Surface Water and Hydrate Minerals on Mars from a Rover, Penetrator, or Borehole: The HYDRA Instrument

Elphic, R. C.; Lawrence, D. J.; Feldman, W. C.; Wiens, R. C.; Tokar, R. L.; Moore, K. R.; Prettyman, T. H.; Funsten, H. O.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

One of the major goals of near term NASA Mars exploration is to identify exact locations of near-surface water or hydrated minerals on Mars. Evidence for the existence of recent nearsurface water on Mars underscores the need for developing instrumentation that can identify water or hydrated minerals very near the surface. Further encouraging evidence of surface and near-surface water and hydrate minerals on Mars comes from neutron spectrometer measurements aboard Mars Odyssey. Preliminary results show very large regions of high hydrogen content poleward of 60 deg. latitude, as well as interesting features closer to the equator. However, spatial resolution from orbit is very poor, approx. 400 km. The next logical step is to use in-situ or near-surface investigations to map in detail some of the most interesting features. Relatively simple instrumentation based on He-3 gas proportional counters were shown to be highly successful on the Lunar Prospector mission in identifying even low levels of enhanced hydrogen abundances. Here we discuss HYDRA, a water- and hydrate-sensing instrument currently being developed under the NASA Mars Instrument Development Program (MIDP). HYDRA is based on Lunar Prospector technology, and is intended as a rover body-mounted instrument, or an instrument on an aerobot, penetrator, hard lander on the surface of Mars, or for borehole stratigraphy applications. Our proposed instrument would be ideal for such platforms as it would be small (less than 7 cm diameter by 10 cm long), low mass (less than 500 g), low power (less than 1W), and have a low data volume per measurement. We use neutron spectrometry (a) because of its proven ability to uniquely detect and quantify hydrogen abundance, and (b) because the resources required by this approach (weight, power, size, telemetry bandwidth, and measurement time) are extremely low. This compact neutron spectrometer package, comprised of two small He-3 gas proportional counters, offers superior sensitivity, extensive flight heritage, and inherent ruggedness. These tubes have survived approx. 1500 g's of acceleration in penetrator tests. In a landed application, HYDRA would help address many topics of interest to the Mars Exploration and Astrobiology communities: (a) nature and origin of stratified deposits; (b) water cycle(s) and temporal changes; (c) early water oceans, aquifers, precipitation; (d) current extent/location/state of water; (e) polar cap processes and temporal changes; (f) where extremeophiles could survive on Mars; (g) paleoclimate surface signatures and modeling; (h) strategies for future Mars exploration.

Derived from text

Mars Exploration; Neutron Spectrometers; Roving Vehicles; Surface Water; Mars Surface

20030066777 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Evolution and Transport of Water in the Upper Regolith of Mars

Hudson, T. L.; Aharonson, O.; Schorghofer, N.; Hecht, M. H.; Bridges, N. T.; Green, J. R.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Long standing theoretical predictions [1-3], as well as recent spacecraft observations [4] indicate that large quantities of ice is present in the high latitudes upper decimeters to meters of the Martian regolith. At shallower depths and warmer locations small amounts of H₂O, either adsorbed or free, may be present transiently. An understanding of the evolution of water based on theoretical and experimental considerations of the processes operating at the Martian environment is required. In particular, the porosity, diffusivity, and permeability of soils and their effect on water vapor transport under Mars-like conditions have been estimated, but experimental validation of such models is lacking. Goal: Three related mechanisms may affect water transport in the upper Martian regolith. 1) diffusion along a concentration gradient under isobaric conditions, 2) diffusion along a thermal gradient, which may give rise to a concentration gradient as ice sublimates or molecules desorb from the regolith, and 3) hydraulic flow, or mass motion in response to a pressure gradient. Our combined theoretical and experimental investigation seeks to disentangle these mechanisms and determine which process(es) are dominant in the upper regolith over various timescales. A detailed one-dimensional model of the upper regolith is being created which incorporates water adsorption/ desorption, condensation, porosity, diffusivity, and permeability effects. Certain factors such as diffusivity are difficult to determine theoretically due to the wide range of intrinsic grain properties such as particle sizes, shapes, packing densities, and emergent properties such as tortuosity. An experiment is being designed which will allow us to more accurately determine diffusivity, permeability, and water desorption isotherms for regolith simulants.

Author

Mars Surface; Mathematical Models; Water Flow; Regolith

20030066779 AVL doo, Zagreb, Croatia

From Topography Profile Diagrams to the Evolution of Oceanus Borealis: Proposal of a Strategy that may Result in the Formal Proof of Martian Ocean Recession, Timing and Probability

Salamuniccar, G.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Papers about ocean on Mars published after the proposal of Contact 1 and 2, can basically be divided into two groups. The first one is based on shoreline theory, but unfortunately, shorelines were not found in required amount. However, papers from the second group, while mostly discussing whether Contact 1 or 2 is better approach, also proposed many additional indicators that ancient ocean may existed on Mars. Some of them are: spiral beaches, sedimentation, hydraulic and thermal arguments, outflow channels and features related to the evolution of standing bodies of water (polygons, lobate impact craters), features consistent with the shoreline interpretation, impact craters, fluvial valleys, MEGAOUTFLO hypothesis, MOLA data, tsunami generation and propagation, glaciers, fluvial channels and gullies, MGS data, erosion features that might be ancient coastal terraces, influence on planetary climate, etc. This is also in consistence with other work done more recently, including the proposal that in the early history of Mars even larger ocean existed up to the named Contact 0. On the other side, discovery of large number of buried impact craters all over the planet surface, indicates that young sediment covers much older surface all over the northern lowlands. While this is very important discovery, it should be noted that it is not a proof that ocean has not existed on Mars. E.g., very large impactor can leave crater even if ocean is 10 km deep. Heavy bombardment at the very early beginning of the planet evolution could also create those (possibly oldest) craters, at the time when surface of the planet was too hot for water to exist in liquid state. Even the much denser atmosphere that would include the water from the hypothetical ocean can not protect the surface from the impactors if the bombardment is too strong. However, once this process is over and surface of the planet cold enough so that water can exist in the form of possibly large ocean, it would prevent most of the impactors to leave craters over the territory it covered. Even today, such global influence on crater distribution has to be detectable using mathematical analysis, as proposed in. However, while like any other mathematical theory the approach is applicable generally, it still needs to be formally proved that it is also applicable to Mars. As the first step, Topography Profile Diagrams (TPDs) representation of topography and correlated values were described, showing high correlation between density of craters and topographic altitude. Additionally, it is also shown that this correlation is not consequence of processes local to only some parts of planet surface, but of some global process. In this paper, possibility that this global process was an ocean will be investigated.

Derived from text

Topography; Diagrams; Evolution (Development); Oceans; Coasts; Mars (Planet)

20030066781 Oulu Univ., Finland

Morphology of the High-Latitude Mantle in Northern Plains on Mars

Kostama, V.-P.; Kreslavsky, M. A.; Head, J. W.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The complex of polar deposits (the polar cap, its icy outliers and dune fields) at the North pole of Mars is surrounded by vast generally flat geologically homogeneous plains. These plains at high latitudes (greater than approx. 55°) are covered with a thin geologically young mantle with specific decameter-scale surface texture containing much water ice. High-resolution MGS MOC images showed many circular features interpreted to be mantled craters. Our objective is to access geological processes that occurred in the region during the Amazonian, and the relative and absolute time scales of these processes, including those related to the origin of the shallow subsurface ice. To approach this goal, we studied the size-frequency distributions of circular features of different morphology, as well as peculiarities of the surface texture. We are carrying out a systematic survey of the high-resolution MOC images in the region. This work is in progress; here we report some preliminary observations.

Derived from text

Morphology; Latitude; Mars Surface; Deposits; Planetary Geology

20030066782 Stanford Univ., Stanford, CA, USA

Radio Occultation Measurements of Pressure Variations on Mars

Hinson, D. P.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Radio occultation sounding of the neutral atmosphere is conducted routinely as part of the Mars Global Surveyor Radio Science (RS) investigation. Each observation yields a profile of temperature and pressure versus radius that extends from the surface to 10 Pa, an altitude interval of 40 km. More than 7000 RS profiles have been acquired since measurements began in January 1998, and these experiments are continuing as part of an ongoing extended mission. The RS profiles are available from both PDS and a more versatile RS Web site. Using these RS profiles, this extended abstract discusses the relationships between Mars latitude, atmospheric pressure variations, geopotential height, wind speed, and temperature.

Derived from text

Atmospheric Pressure; Mars Atmosphere; Radio Occultation; Data Acquisition

20030066783 NASA Ames Research Center, Moffett Field, CA, USA

The Curious Shorelines of Gorgonum Chaos

Howard, A. D.; Moore, J. M.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Level, bench-like platforms in the interior of the Gorgonum Chaos basin appear to be shorelines associated with an ancient lake. These shorelines, however, seem to lack the typical features of shorelines associated with wave and current transport and erosion, such as crescentic embayments, spits, barrier islands, and wave-cut cliffs. Rather, the lake-facing platform edges are commonly rounded and cumulate in planform, often evenly encircling presumed islands. We interpret these shorelines to have been formed by outward growth in a quiescent environment, possibly in ice-covered bodies of water and possibly, in part, as chemical precipitates.

Derived from text

Mars Surface; Terrain; Landforms; Shorelines; Geomorphology; Structural Basins

20030066784 National Air and Space Museum, Washington, DC, USA

Origin of Aeolis Mensae, Mars, Fretted Terrain in a Thick Sedimentary Deposit

Irwin, R. P., III; Watters, T. R.; Howard, A. D.; Maxwell, T. A.; Zimbelman, J. R.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The origin of fretted and knobby terrain on Mars has remained uncertain since the landforms were first described by Sharp in 1973. Subsequent studies have focused primarily on the fretted terrain in northern Arabia Terra, where investigators generally agree that ground ice has been important in modifying knobs and fretted valleys. The initial processes isolating

mesas from the high-standing terrain are less certain. Some fretted channels exhibit characteristics that suggest origin by fluvial erosion, despite their poorly developed drainage networks. Other proposed mechanisms include crustal extension and structural control of groundwater sapping. Situated near the martian equator at the crustal dichotomy boundary, Aeolis Mensae provides a pristine example of fretted terrain development without the younger landforms attributed to ice. We examined an area bounded by 10 deg. S, 0 deg. N, 130 deg. E, and 150 deg. E, adjacent to the cratered and dissected area described by Irwin and Howard. Here we present evidence for a compositional difference between the Aeolis Mensae and the adjacent highland crust, and we discuss the interaction of fluvial valley networks with the dichotomy boundary in this region. Our observations indicate that Aeolis Mensae fretted terrain developed in a thick sedimentary deposit. Sedimentary layers were emplaced and eroded as fluvial activity declined, with minimal influence from highland valley networks.

Derived from text

Terrain; Mars Surface; Deposits; Ice

20030066785 State Univ. of New York, Stony Brook, NY, USA

The Hydrothermal Soil Formation Mechanism: Relevant Conditions and Implications of Experimental Results

Hurowitz, J. A.; McLennan, S. M.; Lindsley, D. H.; Schoonen, M. A. A.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The driving question behind NASA's Mars exploration program is whether or not life was, is, or could be sustained on our neighbor planet. In order to answer that question, we must be informed about the nature of the Martian environment both in the past, and at the present day. The soils at the Martian surface (for this project, broadly defined as the fine, windblown materials analyzed at the Viking and Pathfinder landing sites) hold clues to Martian environmental history, as they may represent the product of interactions between the basaltic Martian crust and liquid water. Unraveling the mechanism(s) by which this globally homogeneous soil blanket formed may reveal a great deal about zones where liquid water once was (and possibly still is) stable on Mars.

Derived from text

Mars Environment; Mars Surface; Soils; Hydrothermal Systems

20030066786 National Air and Space Museum, Washington, DC, USA

Multiple Generations of Martian Valley Networks: Reconciling Extensive Fluvial Erosion with Immature Drainage Systems

Irwin, R. P., III; Maxwell, T. A.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Most studies of martian erosion have focused on crater statistics, aeolian landforms and deposits, and valley network morphology. Previous workers have noted that the martian crater population is deficient in craters less than ~30 km in diameter, presumably due to erosion, and that ancient martian craters were subjected to different erosional processes than craters on airless bodies. The martian record of craters that are visible in imaging is also deficient between 150-300 km diameter relative to the Moon, although many highly degraded or buried craters in this size range are now visible in Mars Orbiter Laser Altimeter (MOLA) topography. Extensive regions of the martian surface have been resurfaced by airfall deposits, although some areas retain 20-50 m deep valley networks and other small scale Noachian landforms. Martian valley networks have a similar appearance to some terrestrial arid-zone counterparts. However, martian drainage densities are spatially variable and can be quite low, appearing highest on crater walls and other steeply sloping terrain. MOLA topography and Viking Orbiter imaging also show numerous remnant highland massifs, with hundreds of meters of vertical relief and relatively steep sides. These features and the degraded impact basins collectively suggest that the extant martian valley networks and impact craters represent only a small fraction of the total erosion and deposition that has affected the martian highlands. Here we describe evidence that martian highland erosion was accomplished by multiple generations of valley networks, which were disrupted and buried by cratering, airfall deposition, and basin infilling. This interpretation reconciles observations of extensively eroded terrain with the limited development of valley networks.

Derived from text

Cratering; Mars Craters; Mars Surface; Structural Basins; Valleys

20030066787 Washington Univ., Hampton, VA, USA

Winter Polar Conditions in the Mars Upper Atmosphere at Both the North and South Poles

Keating, G. M.; Theriot, M.; Tolson, R.; Bougher, S.; Forget, F.; Angelats i Coll, M.; Forbes, J.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Mars Global Surveyor (MGS) z-axis accelerometer has obtained over 1600 vertical structures of thermospheric density, temperature, and pressure, ranging from 110 to 170 km, between Sept. 1997 and March 1999, compared to only three previous such vertical structures from Viking 1, 2, and Pathfinder. In November 1997, a regional dust storm in the Southern Hemisphere triggered an unexpectedly large thermospheric response at mid-northern latitudes, increasing the altitude of thermospheric pressure surfaces there by as much as 8 km and indicating a strong global thermospheric response to a regional dust storm (Keating, et al., 1998). From analysis of the MGS accelerometer data, enormous planetary scale waves have been detected in the Martian thermosphere between 60 N and 60 S. Fourier analysis of the wave structure reveals high amplitude waves 2 and 3 which appear to remain at nearly constant longitude between 60 latitude when viewed near 3 PM. However, measurements near 3 AM show evidence of essentially a phase reversal in wave 2. Taking into account the near sun-synchronous orbit it appears that these waves are principally non-migrating tides propagating to the east. Studies by Wilson et al. and Forbes et al. indicate the wave 2 component is principally an eastward propagating diurnal wave 1 which rotates around Mars in the opposite sense of the sun once per day (the wave 1 Kelvin wave, which principally results from the interaction of tides and topography). Analysis of Thermal Emission Spectrometer (TES) MGS data near 30 km indicates a similar phase to this wave at 30 km and thus the wave appears to propagate up from below into the thermosphere. The observed wave 3 may be a combination of an eastward propagating, semi-diurnal wave 1 and the eastward propagating, diurnal wave 2 (basically the wave 2 Kelvin wave). Both the observed wave 2 and wave 3 maximize near the equator. These results give further evidence of coupling between the lower and upper atmosphere.

Derived from text

Mars Atmosphere; Polar Meteorology; Upper Atmosphere; Lower Atmosphere; Winter; Planetary Waves

20030066788 Arizona Univ., Tucson, AZ, USA

Preliminary Thickness Measurements of the Seasonal Polar Carbon Dioxide Frost on Mars

Kelly, N. J.; Boynton, W. V.; Kerry, K.; Hamara, D.; Janes, D.; Mikheeva, I.; Prettyman, T.; Feldman, W. C.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The exchange of carbon dioxide between the atmosphere and the polar caps on Mars creates a seasonal cycle of growth and retreat of the polar caps. CO₂, the major component of the Martian atmosphere, condenses in the polar regions of the planet during the winter seasons, precipitating as CO₂ frost. It then sublimates during the spring and summer seasons in response to solar radiation. Nearly 30% of the atmosphere takes part in this seasonal process. While the northern seasonal CO₂ frost appears to dissipate completely, the south pole has a thin, permanent cover of dry ice over the residual cap. The underlying residual caps are believed to contain large quantities of water ice. We have attempted here to quantize the time-dependence, spatial extent, and thickness of the polar carbon dioxide frost through the use of gamma-ray data measured by the Gamma-Ray Spectrometer (GRS) instrument suite on Mars Odyssey. After launch on April 7, 2001, Mars Odyssey reached Mars for orbital insertion and began mapping several months later on February 18, 2002. The study discussed here includes data received from solar areocentric longitude L(sub s) 329 deg through 135 deg (February, 2003). Measurements and analyses have been done for the north and south poles, for latitudes poleward of +/- 65 deg, using the hydrogen neutron-capture gamma-ray line at 2.223 MeV.

Derived from text

Mars Atmosphere; Mars Surface; Polar Caps; Carbon Dioxide; Frost; Annual Variations

20030066789 Lockheed Martin Space Systems Co., Denver, CO, USA

Acid Snowbank as Source, Sink and Abode

Clark, Benton C.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Persistent deposits of water ice may exist at the surface, even in certain non-polar regions on Mars. Their origins can include: atmospheric precipitation (snow); surface adsorption; clathrate formation; upward percolation of H₂O vapor or wicking of liquid created by subsurface heat sources; or deflation of overburden to expose buried ice or ice-rich permafrost (for purposes of expediency, such surface-exposed deposits will be referred to in this paper as 'snowbanks', regardless of the

source or mechanism of transport of H₂O to the surface). Many of the characteristics discussed here are relevant to any exposed body of ice. Such deposits may have unique roles as a source of H₂O, a sink of chemically active gases injected into the atmosphere, and through various favorable factors, providing a haven for growth and reproduction of biological organisms on Mars which would, on Earth, be considered extremeophiles.

Derived from text

Ice; Mars Surface; Gas-Solid Interactions; Polar Caps; Acidity

20030066790 NASA Ames Research Center, Moffett Field, CA, USA

Post Impact Mars Climate Simulations Using a GCM

Colaprete, A.; Haberle, R. M.; Segura, T. L.; Toon, O. B.; Zahnle, K.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The first images returned by the Mariner 7 spacecraft of the Martian surface showed a landscape heavily scarred by impacts. Mariner 9 imaging revealed geomorphic features including valley networks and outflow channels that suggest liquid water once flowed at the surface of Mars. Further evidence for water erosion and surface modification has come from the Viking Spacecraft, Mars Pathfinder and Mars Global Surveyor's (MGS) Mars Orbiter Camera (MOC). This evidence includes apparent paleolake beds, fluvial fans and sedimentary layers (Cabrol and Grinn, 1999; Heberle et al., 2001). There is evidence for subsurface water as well. Rampart craters suggest an abundance of water in the near surface regolith (Mouginis-Mark, 1986). The estimated erosion rates necessary to explain the observed surface morphologies (Golombek and Bridges, 2000) present a conundrum. The rates of erosion appear to be highest when the early sun was fainter and only 75% as luminous as it is today. Furthermore the rates of erosion appear to correlate with the rate at which Mars was impacted (Carr and Waenke, 1992). All of this evidence suggests to a very different climate than what exists on Mars today.

Author

Mars Surface; Geomorphology; Water Erosion

20030066791 Hong Kong Polytechnic, Kowloon, Hong Kong

Planetary Micro-End Effectors

Ko, S. M.; Ng, T. C.; Yung, K. L.; Yu, C. H.; Chan, C. C.; Sixth International Conference on Mars; 2003; 1 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Micro-End Effectors (MEE) system was developed by The Hong Kong Polytechnic University covers all aspects of planetary explorations. All sampling tools can be divided into six catalogues: 1) Surface sampling 2) Subsurface sampling 3) Surface coring 4) Subsurface coring 5) Zero gravity sampling 6) Rind Grinding It is designed for long hauled missions with low payload. e.g. Titan - Europa Planets with exobiology values and Mars Rock Corer is responsible for the world 1 ST planetary rock coring in our solar system for ESA 2003 Beagle 2 Mars Lander.

Author

Planetary Geology; Measurement; Exobiology; Mars Surface

20030066792 Washington Univ., Seattle, WA, USA

Enigmatic Surface Features of the South Polar Layered Deposits

Koutnik, M. R.; Byrne, S.; Crawford, Z.; Murray, B. C.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Data from the Mars Orbiter Camera (MOC) and the Mars Orbiter Laser Altimeter (MOLA) aboard the Mars Global Surveyor (MGS) mission have provided important new clues to the past history of the south polar layered deposits (SPLD). There are distinct features presented here that have been observed almost exclusively with these data sets and are unique to the south polar region of Mars. Crawford et al. have studied these features initially and we now present the current perspective on this region after a period of detailed study. We present a descriptive discussion and provide evidence for different possible interpretations. Although we do not conclusively know the origin of these features, we consider that sub-glacial volcanism as well as strong surface winds may have been active in forming these features visible today.

Derived from text

Deposits; Glaciers; Mars Surface; Polar Regions

20030066793 California Univ., Santa Cruz, CA, USA

Can Shoreline Processes on Mars Constrain Its Past Climate?

Kraal, E. R.; Asphaug, E. I.; Lorenz, R. D.; Sixth International Conference on Mars; 2003; 2 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Significant past efforts have been devoted to the mapping of shorelines in Martian crater basins and the use of shoreline morphology to interpret the past Martian climate and hydrologic cycle. If lacustrine geomorphology persists on Mars, it is a rich key to the Martian past. Yet, despite the wealth of imagery and increasing data return from THEMIS on Mars Odyssey, the interpretation of surface morphology lacks insight from a linked quantitative model. In this spirit, we propose to explore the geomorphic system of a crater lake on Mars and how it would respond to climate perturbations (from occasional filling to persistent lake levels and ice cover), keeping in mind the unique initial conditions of an impact structure to the extent that the initial lake bedrock, breccia and layered deposits can be modeled. Our ultimate goal is to understand how shorelines might preserve a quantitative record of Martian climate.

Derived from text

Mapping; Shorelines; Morphology; Mars Surface; Geomorphology; Hydrological Cycle

20030066794 Lunar and Planetary Inst., Houston, TX, USA

Gravity Evidence for Extinct Magma Chamber Systems on Mars

Kiefer, Walter S.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Mars Global Surveyor mission has vastly improved our knowledge of the topography and gravity of Mars, permitting detailed geophysical modeling of subsurface structures such as magma chamber systems for the first time. In this work, I describe gravity models for Syrtis Major, Tyrrhena Patera, and Hadriaca Patera as well as preliminary results for Amphitrites Patera. In each case, flexurally supported surface topography can not explain the observed gravity anomaly. High density, buried material is required at each volcano, most likely as dense cumulate minerals in extinct magma chamber systems. These results provide our first look at the magmatic plumbing of Mars.

Author

Extinction; Gravitation; Magma; Mars Surface; Planetary Geology; Topography

20030066795 Catholic Univ. of America, Washington, DC, USA

Spectroscopy of Mars Atmosphere from Orbiting and Ground-based Observatories: Recent Results and Implications for Evolution

Krasnopolsky, V. A.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains black and white illustrations

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The basic data on the chemical composition of Mars atmosphere were obtained by the Viking mass spectrometers a quarter of century ago. Spacecraft missions to Mars in the last decade have not been aimed to this field, and the current progress is related to high-resolution spectroscopy from orbiting and ground-based observatories.

Derived from text

Mars Atmosphere; Evolution (Development); Mass Spectrometers

20030066796 Brown Univ., Providence, RI, USA

North-South Slope Asymmetry on Mars

Kreslavsky, M. A.; Head, J. W.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

A map of north-south subkilometer-scale slope asymmetry on Mars obtained from statistical analysis of along-track MOLA topographic profiles reveals well-defined latitudinal bands of north-south slope asymmetry at 40-50° in both hemispheres. In these bands the equator-facing slopes are systematically steeper than pole-facing slopes. This asymmetry is especially pronounced for the steepest (less than 20 deg.) slopes: equator-facing ones are three times more frequent. We interpret these bands to be related to insolation asymmetry. Particularly, we suggest that transient melting of ground ice at

pole-facing slopes occurred during the periods of very high obliquity (approx. 45 deg.) in the past and favored downslope mass movement and elimination of steep pole-facing slopes. The map reveals also several other areas of pronounced north-south slope asymmetry. In these areas the asymmetry takes place for gentle slopes. It is interpreted to be caused by prevailing wind direction during formation and modification of surficial deposits.

Author

Slopes; Mars Surface; Planetary Mapping; Asymmetry

20030066798 NASA Ames Research Center, Moffett Field, CA, USA

Definitive Mineralogical Analysis of Martian Rocks and Soil Using the CheMin XRD/XRF Instrument and the USDC Sampler

Blake, D. F.; Sarrazin, P.; Chipera, S. J.; Bish, D. L.; Vaniman, D. T.; Bar-Cohen, Y.; Sherrit, S.; Collins, S.; Boyer, B.; Bryson, C., et al.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The search for evidence of extant or extinct life on Mars will initially be a search for evidence of present or past conditions supportive of life (e.g., evidence of water), not for life itself. Definitive evidence of past or present water activity lies in the discovery of: * Hydrated minerals: The 'rock type' hosting the hydrated minerals could be igneous, metamorphic, or sedimentary, with only a minor hydrated mineral phase. Therefore, the identification of minor phases is important. * Clastic sediments: Clastic sediments are commonly identified by the fact that they contain minerals of disparate origin that could only have come together as a mechanical mixture. Therefore, the identification of all minerals present in a mixture to ascertain mineralogical source regions is important. * Hydrothermal precipitates and chemical sediments: Some chemical precipitates are uniquely identified only by their structure. For example, Opal A, Opal CT, tridymite, cristobalite, high and low Quartz all have the same composition (SiO₂) but different crystal structures indicative of different environments - from hydrothermal hydrothermal formation to low temperature precipitation. Other silica types such as stishovite can provide evidence of shock metamorphism. Therefore, identification of crystal structures and structural polymorphs is important. The elucidation of the nature of the Mars soil will require the identification of mineral components that can unravel its history and the history of the Mars atmosphere.

Author

Mars Surface; Planetary Geology; Geochemistry; Mineralogy

20030066799 Arizona State Univ., Tempe, AZ, USA

Water on Mars: Evidence from Minerals and Morphology

Christensen, P. R.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Summary: The available remote measurements of martian mineralogy and morphology suggest a complex and diverse set of states of martian water. Nearsurface water ice appears to be more abundant than previously considered. Aqueous processes have occurred locally to produce hematite mineralization in isolated regions. However, the lack of extensive carbonates (and clays) and the presence of ancient olivine suggests that liquid water has been rare at or near the surface over time. Together these observations suggest a relatively water-rich surface layer in which water is primarily in a frozen state except for isolated, and very interesting, events.

Author

Mars Surface; Planetary Geology; Mineralogy; Morphology

20030066800 Geological Survey, Flagstaff, AZ, USA

Behavior of Solid CO₂ on Mars: A Real Zoo

Kieffer, Hugh H.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Observations of the martian polar caps by TES, THEMIS and MOC have revealed several unexpected things: now informally known as cryptic material, Dalmatian spots, black spiders, oriented fans and fried eggs. These result from the characteristics and behavior of solid CO₂ on Mars, which is unlike anything on Earth. I will attempt to explain this zoo qualitatively in terms of the interaction of CO₂ and dust with the solar and thermal radiation fields on Mars. Some of these concepts have been published.

Author

Carbon Dioxide; Mars Surface; Solid Cryogenics; Solidified Gases; Mars Atmosphere

20030066801 Eotvos Lorand Univ., Budapest, Hungary

'Breathing Soils' of Mars as Indicators of Subsurface Environment

Kereszturi, A.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Important information hides deep below the surface of Mars for planetology and astrobiology. Our knowledge would be greatly improved on the planetary evolution with physical and chemical information from the subsurface especially on the proposed deep water layer, hydrothermal systems, possible subsurface habitats, volatile reservoir, paleoclimate. Because the impossibility of deep drill on Mars in the next decades we suppose one inexpensive method for the analysis of subsurface environment. In this work the theoretical bases and the possible results are summarized of the breathing process.

Derived from text

Mars Surface; Planetology; Soil Science; Planetary Environments; Hydrothermal Systems

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Paleodischarge Estimation from Morphometry for Ancient Channels

Kereszturi, A.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The mass/volume of water was present at or near to the surface of Mars during the planetary evolution is an important question. The runoff valleys are thought to have formed by sapping, the outflow channels by water or cryoclast flows. The exact style of the flows, the sediment load, the discharge and many other factors are not fully understood. In this work we outline a possible easy morphology based paleodischarge estimation method for martian channel, which is not able to give exact values, only row estimations, but could be easily used because of its simplicity in many cases as a secondary method together with other ones.

Derived from text

Geomorphology; Mars Surface; Drainage; Channel Flow

20030066803 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Seasonal/Diurnal Mapping of Ozone and Water in the Martian Atmosphere

Novak, R. E.; Mumma, M. J.; DiSanti, M. A.; DelloRusso, N.; Magee-Sauer, K.; Bonev, B.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530

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Ozone and water are key species for understanding the stability and evolution of Mars atmosphere; they are closely linked (along with CO, H, OH, and O) through photochemistry. Photolysis of water produces the OH radical (thought to catalyze reformation of CO₂ from CO and O₂) and atomic hydrogen (which reacts with O₃ forming OH and O₂). Atomic hydrogen also reacts with O₂ (forming HO₂), thereby reducing the amount of O₂ available to reform O₃ from collisions between O and O₂. Hence ozone and water should be anti-correlated on Mars. Photolysis of O₃ produces O₂(a(^{sup} 1) Δ g) with 90% efficiency, and the resulting emission band system near 1.27 μ m traces the presence and abundance of ozone. This approach was initially used to study ozone on Earth and then applied to Mars. In 1997, we measured several lines of the O₂(a(^{sup} 1) Δ g) emission using CSHELL at the NASA IRTF; the O₂(a(^{sup} 1) Δ g) state is also quenched by collisions with CO₂. This quenching dominates at lower altitudes so that the detected emissions are used to detect ozone column densities above ~20 km. The slit was positioned N-S along Mars' central meridian resulting in a one-dimensional map of ozone. Nearly simultaneous maps may be made of water using CSHELL by detecting the v₁ fundamental band of HDO near 3.67 μ m and using the D/H ratio for Mars. This technique was used by DiSanti and Mumma. With CSHELL, measurements for both O₂(a(^{sup} 1) Δ g) emissions and HDO absorptions can be made during the day or night. Since January, 1997, we have repeated these measurements at different times during the Martian year. For all of these dates, we have positioned the slit N-S along the central meridian; for some of these dates, we have also stepped the slit across the planet at 1 arc-sec intervals generating a 2-dimensional map. We have also positioned the slit E-W on Mars thus providing diurnal variations of ozone and water along the slit.

Derived from text

Mars Atmosphere; Ozone; Water; Photochemical Reactions; Annual Variations; Thematic Mapping; Mars (Planet); Diurnal Variations

20030066804 NASA Ames Research Center, Moffett Field, CA, USA

A One Billion Year Martian Climate Model: The Importance of Seasonally Resolved Polar Caps and the Role of Wind
Armstrong, J. C.; Leovy, C. B.; Quinn, T. R.; Haberle, R. M.; Schaeffer, J.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Wind deflation and deposition are powerful agents of surface change in the present Mars climate regime. Recent studies indicate that, while the distribution of regions of potential deflation (or erosion) and deposition is remarkably insensitive to changes in orbital parameters (obliquity, timing of perihelion passage, etc.), rates of aeolian surface modification may be highly sensitive to these parameters even if the atmospheric mass remains constant. But previous work suggested the atmospheric mass is likely to be sensitive to obliquity, especially if a significant mass of carbon dioxide can be stored in the regolith or deposited in the form of massive polar caps. Deflation and erosion are highly sensitive to surface pressure, so feedback between orbit variations and surface pressure can greatly enhance the sensitivity of aeolian modification rates to orbital parameters. We used statistics derived from a 1 Gyr orbital integration of the spin axis of Mars, coupled with 3D general circulation models (GCMs) at a variety of orbital conditions and pressures, to explore this feedback. We also employed a seasonally resolved 1D energy balance model to illuminate the gross characteristics of the longterm atmospheric evolution, wind erosion and deposition over one billion years. We find that seasonal polar cycles have a critical influence on the ability for the regolith to release CO₂ at high obliquities, and find that the atmospheric CO₂ actually decreases at high obliquities due to the cooling effect of polar deposits at latitudes where seasonal caps form. At low obliquity, the formation of massive, permanent polar caps depends critically on the values of the frost albedo, A(sub frost), and frost emissivity, E(sub frost). Using our 1D model with values of A(sub frost) = 0.67 and E(sub frost) = 0.55, matched to the NASA Ames GCM results, we find that permanent caps only form at low obliquities (< 10 degrees). Thus, contrary to expectations, the Martian atmospheric pressure is remarkable static over time, and decreases both at high and low obliquity. Also, from our one billion year orbital model, we present new results on the fraction of time Mars is expected to experience periods of high and low obliquity. Finally, using GCM runs at a variety of pressures, we examine the likely role of wind erosion under an early more massive Martian atmosphere.

Author

Mars Atmosphere; Atmospheric General Circulation Models; Atmospheric Circulation; Climate Models; Polar Caps; Wind (Meteorology)

20030066806 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Operation of MRO's High Resolution Imaging Science Experiment (HiRISE): Maximizing Science Participation

Eliason, E.; Hansen, C. J.; McEwen, A.; Delamere, W. A.; Bridges, N.; Grant, J.; Gulich, V.; Herkenhoff, K.; Keszthelyi, L.; Kirk, R., et al.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Science return from the Mars Reconnaissance Orbiter (MRO) High Resolution Imaging Science Experiment (HiRISE) will be optimized by maximizing science participation in the experiment. MRO is expected to arrive at Mars in March 2006, and the primary science phase begins near the end of 2006 after aerobraking (6 months) and a transition phase. The primary science phase lasts for almost 2 Earth years, followed by a 2-year relay phase in which science observations by MRO are expected to continue. We expect to acquire approx. 10,000 images with HiRISE over the course of MRO's two earth-year mission. HiRISE can acquire images with a ground sampling dimension of as little as 30 cm (from a typical altitude of 300 km), in up to 3 colors, and many targets will be re-imaged for stereo. With such high spatial resolution, the percent coverage of Mars will be very limited in spite of the relatively high data rate of MRO (approx. 10x greater than MGS or Odyssey). We expect to cover approx. 1% of Mars at approx. 1m/pixel or better, approx. 0.1% at full resolution, and approx. 0.05% in color or in stereo. Therefore, the placement of each HiRISE image must be carefully considered in order to maximize the scientific return from MRO. We believe that every observation should be the result of a mini research project based on pre-existing datasets. During operations, we will need a large database of carefully researched 'suggested' observations to select from. The HiRISE team is dedicated to involving the broad Mars community in creating this database, to the fullest degree that is both practical and legal. The philosophy of the team and the design of the ground data system are geared to enabling community involvement. A key aspect of this is that image data will be made available to the planetary community for science analysis as quickly as possible to encourage feedback and new ideas for targets.

Author

Mars Missions; High Resolution; Imaging Techniques

20030066807

Intriguing Dark Streaks on Mars: Can We Use Them for Formal Proof That We Are Near the End of Large Climate Change on Mars?

Salamuniccar, G.; Nezc, Z.; Sixth International Conference on Mars; July 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy; Available on CD-ROM as part of the entire parent document

After the initial proposal that crater statistics based mathematical analysis can give us some new information about the history of Mars, Topography Profile Diagrams (TPDs) were proposed showing high correlation between density of craters and topographic altitude. It was also shown that this correlation is not consequence of processes local to only some parts of the planet surface. One possible explanation is that large ocean caused this correlation, which is consistent with the recent proposal that at the early history of Mars even larger ocean existed than previously believed named Contact 0. All this indicates that large climate change happened at least once during the Martian history. However, the theory that Mars did not change a lot during the most of its history is still the possibility many still investigate. However, if it can be proved that we still have climate changes on Mars, then it will also be most likely that we had climate changes in the past too. In this paper, some interesting aspects of the dark streaks on Mars will be presented, that may be the key for the above question.

Derived from text

Climate Change; Mars Surface; Topography

20030066808 AVL doo, Zagreb, Croatia

Image Processing Algorithms for Visualization of Quasi-Circular-Depressions: A Step Toward the Automatic Process of Detection and Classification of Martian Buried Impact Craters

Salamuniccar, G.; Selar-Glavovic, D.; Sixth International Conference on Mars; July 2003; 4 pp.; In English; See also 20030066530; Original contains color and black and white illustrations; Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy; Available on CD-ROM as part of the entire parent document

After the initial proposal that craters statistics based mathematical analysis can give us some new information about the history of Mars, Topography Profile Diagrams (TPDs) were proposed showing high correlation between density of craters and topographic altitude. Additionally, it was shown that this correlation is not consequence of processes local to only some parts of the planet surface, what generally can cause for some altitude lower average density of craters. Such global correlation indicates that there was also some global physical process that caused it. All present explanations that something else than the large ocean caused this correlation, does not offer acceptable theory. This is also in consistence with other recent work that proposes that even larger ocean existed then proposed as Contact 1 and 2, named Contact 0. On the other side, discovery of large number of buried impact craters all over the planet surface, indicates that significant sediment covers much older surface all over the northern lowlands. While this does not exclude possibility of the ancient ocean (e.g. very large impactor can leave crater even if ocean is 10 km deep), discovery of buried impact craters is very important for understanding Martian history as well as for the any methodology based on craters statistics. For both reasons, it is of importance all Martian buried craters to be found and classified. Automatic process particularly with this class of craters can be of large help, not only to help in detection of some of craters that could be overseen, but also to help decision what is and what is not buried impact crater to be more objective. As the first step in this way, in this paper image processing algorithms for better visualization of Quasi-Circular-Depressions (QSDs) were proposed, offering some new capabilities according to the tools used for search of QSDs described.

Derived from text

Algorithms; Image Processing; Mars Craters; Mars Surface; Topography

20030066809 Arizona Univ., Tucson, AZ, USA

Abundance and Distribution of Ice in the Polar Regions of Mars: More Evidence for Wet Periods in the Recent Past

Boynton, W. V.; Chamberlain, M.; Feldman, W. C.; Prettyman, T.; Hamara, D.; Janes, D.; Kerry, K.; Sixth International Conference on Mars; 2003; 4 pp.; In English; See also 20030066530; Original contains color illustrations; Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy; Available on CD-ROM as part of the entire parent document

In our earlier work we showed that the south polar region of Mars had high contents of subsurface ice. This conclusion was based on a preliminary analysis of data from the Mars Odyssey Gamma-Ray Spectrometer instrument suite. Subject to the assumptions made at the time, the GRS observations in the south polar region could be fit to a two-layer model consisting of a dry upper layer with low hydrogen content and an ice-rich lower layer. The upper layer ranged in H content, expressed as H₂O, ranging from 2% near -45 latitude to 3% near -75. The thickness of the upper layer, expressed as column density,

ranged from less than 100 g/sq cm at -55 latitude to 40 g/sq cm near -75 . The ice content of the lower layer was inferred to be 35 15% with the higher end of the range preferred.

Derived from text

Ice; Polar Regions; Mars Surface

20030066810 Bordeaux Univ., France

On the Determination of Local Sites for Shallow Ground Water Prospection Using Low Frequency Sounding Radars on Mars

Heggy, E.; Paillou, P.; Mangold, M.; Costard, F.; Clifford, S.; Berthelier, J. J.; Sixth International Conference on Mars; 2003; 3 pp.; In English; See also 20030066530; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Low frequency sounding radars should be able to probe the Martian subsurface layers down to varying depths, depending on the geo-electrical properties of the sounded sites. We present in this work four frequency dependent geo-electrical models of the Martian subsurface in the 1-20 MHz frequency band, based on laboratory electromagnetic characterization of Martian soil analogues. Those models correspond to local Martian sites, where we considered particular interest for the search of water using mainly the Ground Penetrating Radar (GPR) instrument of the Netlander mission. Results and discussion are also valid for both sounding experiments MARSIS and SHARAD. The four models of the Martian subsurface are designed to represent terrains where recent fluvial like features suggest the presence of near subsurface ground ice and probably liquid water. We performed measurements on volcanic and sedimentary materials that may be present on these sites under the appropriate geophysical conditions that may exist in those terrains. We then simulated the backscattered radar echo arising from each site in the 2 MHz frequency band, using the Finite Difference Time Domain (FDTD) algorithm, in order to evaluate the instrument performances to probe the subsurface stratigraphy of each site. Our results confirm that the near subsurface rich iron oxide mineralogy controls the instrument performances in terms of penetration depth and signal to noise ratio in the 2 MHz frequency band. We also discuss the geophysical and geo-electrical sounding conditions that could lead to an ambiguous detection of shallow subsurface water on Mars for the Netlander GPR. Finally we hope to present by the conference time a terrestrial test analogue site selected according to those criteria where deep sub-surface water have been detected 600 m deep using a prototype of the 2 MHz Netlander GPR in a field survey performed last february in the eastern part of the Egyptian desert.

Author

Mars Surface; Ground Penetrating Radar; Radar Geology; Radar Measurement; Sounding; Shallow Water; Surface Water

20030067016 Miyagi Univ. of Education, Japan

Locations and Compositions of Mare Ponds in South Pole-Aitken Basin on the Moon and Its Implication to the Impact Tectonics

Takata, T.; Hori, S.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Locations and compositions of mare ponds in South pole-Aitken (SPA) basin are correlated to the structure of the SPA impact basin. The coverage of mare emplacements indicates that, inside the inner ring, the floor is relatively filled with mare deposits, whereas, in the regions of just inside the middle and outer rings, some mare extrusions exist. The lack of Hi-Ti basalt in mare ponds could result from the subsurface structure of the SPA post impact. Introduction: Most of volcanic activities were taken

Author

Moon; Tectonics; Volcanoes; Lunar Maria; Meteorite Craters

20030067017 Academy of Sciences (USSR), Moscow, USSR

Early Accretion and Differentiation of Protoplanetary Bodies and Hf-W Chronometry

Vityazev, A. V.; Pechernikova, G. V.; Bashkirov, A. G.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The extinct ^{182}Hf - ^{182}W isotope system has been widely applied to date core formation in planetary bodies (e.g., [1]). New Hf-W data for C and H chondrite meteorites [2-4] lead to very rapid accretion and early core formation of asteroids and terrestrial planets: 3-4 Ma for the Vesta, less than 30 Ma and less than 15 Ma for the Earth and Mars cores formation

respectively [2, 3]. According to analytical calculations [5] and computer simulation [6] last stages accretion process of terrestrial planets the value of 100 Ma is preferable. We suggest here other interpretation of new chondritic ratio 182W/184W and the Solar system initial 182Hf/180Hf: these data tell us about initial differentiation in large terrestrial planetesimals and protoplanets at the stage of large impacts before the end of accretion of terrestrial planets. In this scenario Earth's core and Moon were formed later but before late bombardment stage.

Author

Moon; Meteorites; Hafnium

20030067019 University of Northern Arizona, Flagstaff, AZ, USA

A New View of Martian Impact Craters

Barlow, N. G.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Mars Global Surveyor and Mars Odyssey instruments have acquired a plethora of new information about martian impact craters. The combination of high resolution multispectral images, topography, mineralogy, and thermal inertia has expanded our understanding of the morphologic and morphometric variations associated with martian impact craters. The new data are allowing us to investigate the formation mechanisms of craters and their associated features in a level of detail previously unavailable.

Author

Mars Craters; Mars Surface; Mars Photographs; Cratering; Topography; Mineralogy; Thermal Emission

20030067020 Imperial Coll. of Science, Technology and Medicine, London, UK

The Impact Rate of Small Asteroids at the Earth's Surface

Bland, P. A.; Artemieva, N. A.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Artemieva and co-workers have developed a model that calculates motion, aerodynamic loading, and ablation, for each individual particle or fragment. We have used the separated fragments (SF) model to understand fragmentation and ablation in the Earth's atmosphere for a range of impactor types and masses, in addition to a pancake model, and a simple ablation model. The benefit of the SF approximation is that it allows us to define a mass-velocity distribution at the surface for solid fragments which either create craters (in the case of high final velocity) or which may be found as meteorites (fragments with low final velocity) ie. for a given impactor at the top of the atmosphere, it allows us to predict the mass-velocity-distribution for that impactor at the Earth's surface. The flux at the upper atmosphere has recently been well constrained over a large portion of the mass range. In addition, asteroid spectroscopy and impactor composition in large terrestrial craters place constraints on the composition of the flux at the top of the atmosphere. A knowledge of the fragmentation and ablation behavior for a given initial mass and impactor type allows us to estimate the energy and mass delivered to the surface, so that the flux curve for the upper atmosphere can be scaled to an impact rate at the Earth's surface.

Derived from text

Asteroid Collisions; Earth Surface; Rates (Per Time); Cratering

20030067026 Guelph Univ., Ontario, Canada

The Eastern Hudson Bay Arc, Canada: Part of a Multi-Ringed Basin

Brookfield, Michael E.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Almost 35 years ago, Beals proposed an impact origin for the great eastern arc of Hudson Bay, which extends for almost 650 kilometers through an angle of 155 degrees and has a coherent circular raised rim on its landward side. A rift extends at right angles outwards on the southeastern side and within the arc, the basin is filled with Proterozoic sediments. The best fit circle has a radius of 230 kilometers and the arc deviates from this circle by less than 10 km along its entire length. More recently, Goodings and Brookfield noted that closing the James Bay rift aligns the Sutton ridge to form an arc of 240 degrees, or two-thirds of a circle. The remainder is cut by the younger circular northern James Bay cratonic basin. Apart from impact, no other plausible explanation has been proposed for this great ring fracture (and another ring may exist outside this one). But, because no definitive evidence of impact was found, little has been published on the Hudson Bay arc since 1968. Recent

studies of multi-ringed basins on other planets, and of other large, old, multi-ringed basins, such as Vredefort, on Earth, provide criteria for re-investigation and re-interpretation of published reports. Along the Hudson Bay arc, bodies of pseudotachylite, monomict, and exotic breccias are associated with faults, and overlying sediments may show evidence of re-worked impact melts. If ongoing investigations are positive, Hudson Bay arc would form part of the largest identified multi-ringed impact on Earth, with a minimum diameter of 450 kilometers.

Author

Hudson Bay (Canada); Meteorite Craters; Structural Basins; Geological Faults

20030067032 Museum fuer Naturkunde, Berlin, Germany

Additional Observations on the Impact Breccias of the Chicxulub Ejecta Blanket from the UNAM-7 Drill Core, Yucatan, Mexico

Schoenian, F.; Salge, T.; Stoeffler, D.; Fucugauchi, J. Urrutia; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color illustrations

Contract(s)/Grant(s): DFG-GRK-503; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

In 1994/95 a shallow drilling program was carried out by the Universidad Nacional Autonoma de Mexico (UNAM) within and around the Chicxulub crater. 7 drill cores were recovered (2800 m in total), only three of which encountered impact breccias (UNAM-5 at Santa Elena, 110 km S from center, UNAM-7 near Tekax, 125 km SE from center, UNAM-6 near Peto, 150 km SSE from the center). These breccias provide an excellent opportunity to compare the proximal Chicxulub ejecta with that of the well studied Ries crater in Germany.

Derived from text

Core Sampling; Ejecta; Craters; Impact

20030067036 California Univ., Los Angeles, CA, USA

Lunar Prospector Data Imply an Age of 4.1 Ga for the Nectaris Basin, and Other Problems with the Lunar ‘Cataclysm’ Hypothesis

Warren, P. H.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Lunar polymict impactite samples have yielded ages that are remarkably clustered near 3.9 Ga, especially for impact melt breccias. This curiously unimodal age spectrum represents one of the most profound discoveries of planetary sample research. It clearly indicates that the rate of cratering (i.e., collisions between the Moon and asteroids and comets) was vastly higher approx. 3.9 billion years ago than it has been over the last 85% of solar system history. The bombardment history before 3.9 Ga has been most controversial. The relative scarcity of ages greater than 3.9 Ga has led many, in recent years most notably Ryder to infer a spike in the global lunar cratering rate at approx. 3.9 Ga. Following Tera et al., this cratering spike concept is somewhat confusingly known as the lunar ‘cataclysm’ hypothesis. A broader, generally accepted hypothesis known as ‘late heavy bombardment’ simply postulates vastly higher, more destructive lunar cratering at approx. 3.9 Ga, without regard to the spike question. The controversy concerns the degree to which the clustered approx. 3.9 Ga ages reflect a large-factor and global spike, as opposed to a bump or inflection on a basically monotonic decline in the late-accretionary impact rate.

Author

Lunar Maria; Chronology; Cratering; Lunar Evolution

20030067037 NASA, Washington, DC, USA

The Dependence of Target Properties Upon Fresh Crater Morphologies on Mars

Whitehead, J.; Grieve, R. A. F.; Garvin, J. B.; Spray, J. G.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Viking and Mars Orbiter Camera (MOC) images for approx. 900 ‘fresh’ complex craters were chosen for inspection from a database of 1599 complex craters for which physical attributes have been obtained using the Mars Orbiter Laser Altimeter (MOLA). Preliminary analysis revealed that many of the complex craters have been significantly modified by various processes of denudation, as well as partial or complete infilling with sediments +/- impact melt +/- lava, considerably shallowing many of the craters. This study confirms that the majority of the 894 sampled complex craters are affected by such processes. In 474 cases (52%), no central peaks were observed owing to erosion or burial. Of the remaining craters with visible

central peaks, 159 of the freshest craters were selected for further study. These were chosen based on: the absence of significant infilling materials; the presence of a sharp rim and, typically; the preservation of the finer scale morphologic features of the associated ejecta blanket. These craters were used in order to assess the association between the target type and various central peak morphologies, ejecta types and crater depth/diameter relations.

Derived from text

Mars Craters; Mars Photographs; Mars Surface; Image Analysis

20030067042 Yamaguchi Univ., Japan

Impact Drilled Samples of Buried Crater Structure from Takamatsu-Kagawa District in Japan

Miura, Y.; Koga, N.; Nakamura, A.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Surface shocked materials lifted from crater bottom with later andesitic intrusion along cracks are reported by previous papers at Takamatsu-Kagawa district from Busshozan-Cho, Takamatsu-City to Kagawa-cho, Kagawa Prefecture, Shikoku Islands, Japan. Drilled samples to 1,750m in depth are collected every 10m intervals as slice grains are studied by separated preliminary reports. The purpose of the present paper is to make drilled profiles and to elucidate shocked materials of quartz and Fe-Ni particles from buried craters which is probably related with formation of Japanese islands and Sea of Japan in Miocene Tertiary.

Derived from text

Drilling; Meteorite Craters; Sampling; Sediments; Structural Properties (Geology); Sea Of Japan

20030067043 Yamaguchi Univ., Japan

Possible Impact Craters in China: Preliminary Report

Miura, Y.; Li, J. B.; Nakamura, A.; Hu, X.; Maeda, T.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

There are few reports of impact crater in China, because large China continents consists of a few smaller continents by continental drift including Japanese old basements from southern parts of the Equator. Japanese first impact crater research can be applied to survey first China impact crater. In fact, senior author used Yamaguchi University academic fund of China - Japan Academic Exchange of 2002FY, to collect the samples at candidates of Chinese crater one month of summer holiday period of 2002. From satellite images and geological maps, we visited eight locations of wide China country to find best candidates of China crater region of Qinghai Province, western highlands of China. Purpose of the present paper is to discuss possible impact craters in China from geological-topographic maps and satellite images.

Derived from text

China; Topography; Impact Melts; Meteorite Craters; Satellite Imagery; Geological Surveys

20030067045 Neuchatel Univ., Switzerland

Multiple Impacts Across the Cretaceous-Tertiary Boundary

Adatte, T.; Keller, G.; Stinnesbeck, W.; Harting, M.; Stueben, D.; Kramar, U.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The spread in ages of spherules in sedimentary rocks across the Cretaceous-Tertiary boundary suggests that multiple impacts (e.g. a comet shower) occurred during that time, instead of only the one which produced the Chicxulub crater.

CASI

Cretaceous-Tertiary Boundary; Spherules; Strata

20030067046 Academy of Sciences (USSR), Moscow, USSR

Interaction of the Ejecta Plume and the Atmosphere During the Deposition of the Uppermost Suevite Layers at the YAX-1 Drilling Site, Chicxulub, Mexico

Artemieva, N. A.; Stoeffler, D.; Hecht, L.; Schmitt, R. T.; Tagle, R.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color illustrations

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The ICDP drilling Yaxcopoil-1, located in the annular ring trough of the 190 km Chicxulub peak ring impact basin, exposes some 100 m of polymict, melt-rich suevitic breccias below 795 m of post-impact Tertiary sediments. The suevitic breccia section has a layered structure in which 6 units can be defined. The upper two units, some 29 m thick, display a very unusual fine grain size and a distinct grain size sorting which is distinctly different from the underlying suevitic layers and is unknown from any other large impact crater at a corresponding geologic position, e. g. the Ries crater. We use 3D numerical modeling of the impact event to reproduce interaction of vapor plume, solid and molten ejecta, atmosphere and to estimate the time-scale and atmospheric conditions for suevite deposition.

Derived from text

Deposition; Drilling; Ejecta; Plumes; Planetary Cores; Mexico; Meteorite Craters

20030067047 Academy of Sciences (USSR), Moscow, USSR

Distal Ejecta from the Ries Crater: Moldavites and Projectile

Artemieva, N. A.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color illustrations

Contract(s)/Grant(s): RFBR-01-05-64564-a; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Using detailed geological, petrographic, geochemical, and geographical constraints we have performed numerical modeling studies that relate the Steinheim crater ($D_a = 3.8$ km), the Ries crater ($D_{sub a} = 24$ km) in Southern Germany, and the moldavite (tektite) strewn field. The known moldavite strewn field extends from about 200 to 450 km from the center of the Ries to the ENE forming a fan with an angle of about 57 deg. An oblique impact of a binary asteroid from a WSW direction appears to explain the locations of the craters and the formation and distribution of the moldavites. In a presented study we attempt to answer more questions concerning this particular strewn field as well as other questions common for all tektites. What is the maximum 'numerical' size of the moldavite strewn field? How is this size connected with the crater size and the impact conditions? How many tektites may be found theoretically without weathering and surface erosion? What is the size of tektites? Why they are not contaminated by projectile? Where is the projectile material?

Author

Meteorite Craters; Ejecta; Moldavite; Tektites; Mathematical Models

20030067048 NASA Johnson Space Center, Houston, TX, USA

Effects of Pre-Existing Target Structure on the Formation of Large Craters

Barnouin-Jha, O. S.; Cintala, M. J.; Crawford, D. A.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The shapes of large-scale craters and the mechanics responsible for melt generation are influenced by broad and small-scale structures present in a target prior to impact. For example, well-developed systems of fractures often create craters that appear square in outline, good examples being Meteor Crater, AZ and the square craters of 433 Eros. Pre-broken target material also affects melt generation. Kieffer has shown how the shock wave generated in Coconino sandstone at Meteor crater created reverberations which, in combination with the natural target heterogeneity present, created peaks and troughs in pressure and compressed density as individual grains collided to produce a range of shock mineralogies and melts within neighboring samples. In this study, we further explore how pre-existing target structure influences various aspects of the cratering process. We combine experimental and numerical techniques to explore the connection between the scales of the impact generated shock wave and the pre-existing target structure. We focus on the propagation of shock waves in coarse, granular media, emphasizing its consequences on excavation, crater growth, ejecta production, cratering efficiency, melt generation, and crater shape. As a baseline, we present a first series of results for idealized targets where the particles are all identical in size and possess the same shock impedance. We will also present a few results, whereby we increase the complexities of the target properties by varying the grain size, strength, impedance and frictional properties. In addition, we investigate the origin and implications of reverberations that are created by the presence of physical and chemical heterogeneity in a target.

Author

Meteorite Craters; Shapes; Surface Geometry; Surface Roughness Effects; Surface Roughness; Cratering

20030067050 University of Northern Arizona, Flagstaff, AZ, USA

Comparison Study of Layered Ejecta Morphologies Surrounding Impact Craters on Ganymede and Mars

Neal, J.; Barlow, N. G.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Voyager and Galileo imagery reveal that layered ejecta morphologies occur around some impact craters on Ganymede [1, 2]. Similar morphologies surrounding martian impact craters are commonly attributed to the role of subsurface ice. We are studying the similarities and differences between the layered ejecta morphologies on Ganymede and Mars to investigate how impact into increasing amounts of target ice affect these ejecta morphologies.

Derived from text

Analogies; Craters; Ejecta; Mars Craters; Mars Surface

20030067052 New Brunswick Univ., Fredericton, New Brunswick, Canada

Differential Stress-controlled Deformation of Quartz During and After Hypervelocity Impact: Microstructural Evidence from the Charlevoix Impact Structure, Quebec, Canada

Trepmann, C. A.; Spray, J. G.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The presented quartz microstructures acquired during and after hypervelocity impact are differential stress-controlled rather than induced by the compressional pressure component of the shock wave associated stress tensor. They provide information on the magnitude of the differential stress and on the stress field during shock. Crystal-plastic deformation is proposed to have been taken place during post-shock relaxation, at temperatures still sufficient and strain rates low enough to allow movement of dislocations. We feel that such observations may be significant for the understanding of the cratering process and shock waverock interaction.

Derived from text

Canada; Deformation; Hypervelocity Impact; Microstructure; Quartz; Stress Distribution

20030067053 Thery (Jean-Michel), Tours, France

New Laboratory Results on Field Sections at the Impact Crater of Araguainha (MT, GO, Brazil). Area of Proximal and Distal Impact Ejecta, Including Microspherules Dated from the End of Permian

Thery, Jean-Michel; Crosta, A.; Akos, E. Veto; Bilal, E.; Gal-Solymos, K.; Dransart, E.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Araguainha Impact crater is located in Brasil in the northeastern part of Parana Basin: latitude -16 deg 77 min, longitude -52 deg 58 min. Its diameter is 40 Km. W.Engelhardt (1992) and A.P. Crosta (1981) are amiss the first with Dietz and French (1972) to recognize, this crater as astrobleme. We have to give a right credit to all geologists, who worked there before. On the impact crater at Araguainha and neighboring areas, we have obtained new data during our field survey carried out in July 1998 with A. Crosta. The purpose of the present paper is to give an outline of our research. The samples collected within the crater and in neighbouring localities have provided a clear understanding of the stratigraphy of the Permian-Triassic boundary (PTB) at the time of impact. As a result of a careful choice of twelve new sample locations in the area of the crater itself, we have been able to discern some of the nature and constitutions of the breccia and dikes. Subsequently, the constituents were studied thoroughly by petrographic analyses. The layered nature of the breccia allowed us to establish an order in the deposits. The results from petrographic thin sections and Scanning Electron Microscopy/EDAX studies were compared. We systematically analysed the Landsat MSS and the Landsat Thematic Mapper images (already studied in [2], and [3]), from the outcrop areas, in order to obtain a correct map base for our interpretations.

Derived from text

Craters; Petrography; Stratigraphy; Geology; Hypervelocity Impact; Ejecta; Boundaries; Spherules

20030067055 Oulu Univ., Finland

Collapses and Depressions Post-Dating Crater Formation in Martian Impact Structures: Distribution and Consequences

Korteniemi, J.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The surface of Mars, especially the southern highlands, is saturated with impact craters. These structures display a variety of types, such as rampart, polygonal and double ring craters. This may depend on the local geological environment at the time of the impact and after it. Craters with distinctive depressions on their floors are found around the planet. The pits, collapses and depressions in such craters have clearly formed after the initial formation of the parent crater, and they seem to be unrelated to the crater age. Some of the depressions follow the circular crater shape, and almost none of them breach the crater rim. Thus they are clearly related to the crater structure and definitely not random. This study gives an overview on the distribution of the craters in question. It also classifies them into subtypes, and tests and suggests possible causes for the particular phenomena involved.

Derived from text

Mars (Planet); Mars Surface; Mars Craters; Gravitational Collapse; Geochronology; Hypervelocity Impact

20030067065 Oulu Univ., Finland

The Lacustrine Reservoirs in Hellas Impact Basin Region

Lahtela, H.; Kostama, V.-P.; Aittola, M.; Oehman, T.; Raitala, J.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color and black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Hellas Basin in the southern hemisphere of Mars has a depth of approx. 9 km and a diameter of approx. 2000 km, which makes it one of the largest multi-ring impact basins in the solar system. The impact itself could have been an oblique one with a trajectory from NW. Despite numerous evidences (deeper excavation and steeper walls on the uprange profile, higher and more densely concentrated massifs in the downrange rim lobe, etc.) for this hypotheses, it still must be considered as speculative. Hellas influence on the evolution of Mars since the basin's formation in the Early Noachian has been enormous. An obvious outcome of the impact are concentric and radial fractures and graben, which have in turn affected e.g. drainage patterns and the morphology of younger craters. It has also been suggested that the formation of volcanic paterae and associated plains on the NE and S rims of Hellas basin and even the enigmatic volcanic region around Alba Patera antipodal to Hellas might have been controlled by the Hellas impact. Hellas influences also the modern-day Mars, since numerous regional and global dust storms originate from the Hellas region. All these processes result in a geologically versatile region which is seen, for example, in the diverse crater population.

Derived from text

Craters; Depth; Downrange; Fractures (Materials); Geological Faults; Impact Tests; Mars Environment

20030067103 Museum fuer Naturkunde, Berlin, Germany

The Cretaceous Sequence of the Chicxulub YAX-1 Drillcore: What is Impact-derived?

Kenkmann, T.; Wittmann, A.; Scherler, D.; Stoeffler, D.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color and black and white illustrations
Contract(s)/Grant(s): DFG-KE-732-8; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The Yaxcopoil-1 (Yax-1) borehole was drilled 60 km SSW of the center of the Chicxulub impact crater within the annular trough between peak ring and crater rim down to a depth of 1510 m. After penetrating 795 m of post-impact sediments of Tertiary age, about 100 m of suevites and melts and 615 m of Cretaceous sediments were recovered. The Cretaceous rocks consist of dolomites, limestones, and anhydrites, the latter representing 29-30% of the sequence. The age of the sequence is constrained at two levels: (1) at 1495-1455 m, where planktic foraminifers can be correlated with the Bonarelli event near the Cenomanian-Turonian boundary and near the top of the sequence, where a Maastrichtian age was derived.

Derived from text

Boundaries; Craters; Rocks; Impact

20030067104 Academy of Sciences (USSR), Moscow, USSR

Effect of the Supposed Giant Impact Crater on the Geologic Evolution of the Ural Mountain Range

Burba, G. A.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

At the eastern outskirts of the European part of Russia there are the Ural Mountains, which marks the border between Europe and Asia. This mountain range have in general the straight linear position N to S along 60° E meridian. Such position changes abruptly within the middle segment of the range, between 54 and 59° N, where the mountain chains curves eastward along the semicircular outline. Such change looks to be caused by some obstacle, the lithospheric heterogeneity. This

eastward-looking arc of the Middle Ural Mountains is considered here as an eastern segment of a large ring structure, which is referred hereafter as Middle-Ural Ring Structure (MURS). The structure is located between 54 and 59 N, 52 and 62 E. The minimal diameter of its rim is 400 km.

Author

Meteorite Craters; Mountains; Structural Basins

20030067105 Bayreuth Univ., Germany

Synthesis of Nanocrystalline Diamond and 6H Diamond Polytype

Dubrovinskaia, N.; Dubrovinsky, L.; Langenhorst, F.; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Natural elemental carbon occurs in its low pressure polymorph graphite (2H space group P6₃/mmc or 3R space group R3m) and the high pressure polymorphs, cubic diamond (space group Fd3m) and hexagonal lonsdaleite (space group P6₃/mmc). Trace amounts of fullerenes were encountered in carbonaceous residues chemically extracted from carbonaceous meteorites and some terrestrial impact breccias. Graphite, diamond and lonsdaleite occur in many meteorites as shock products, particularly in ureilites and iron meteorites, and in a variety of terrestrial impact rocks. The graphite-to-diamond and graphite-to-lonsdaleite phase transformations are reconstructive and require a change in the bonding type from sp² to sp³. Details of the transformation mechanisms and of the carbon phase diagram at high pressures and temperatures are however still not clear. To decipher the formation mechanisms and conditions of natural events (like meteoritic impacts), it is hence required to better understand the stable and metastable relations in the carbon system. Here we report synthesis of a bulk sample of nanocrystalline cubic diamond and a new 6H diamond-like polytype with crystallite sizes of 8-12 nm. The sample was synthesized from fullerene C₆₀ at 20(1) GPa and 2000(50)C in a multi-anvil apparatus. Our findings indicate that the mechanism and products of transformations in the carbon phases depend strongly on the P-T-path and the structural state of the starting material.

Derived from text

Meteorite Collisions; Nanocrystals; Phase Transformations; Synthesis (Chemistry); Meteoritic Diamonds

20030067109 University of Northern Colorado, Greeley, CO, USA

Late Devonian Alamo Event, Nevada, USA; Multiple Evidence of an Off-Platform Marine Impact

Morrow, J. R.; Sandberg, C. A.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Given the high probability that craters from pre-Pangea oceanic impacts may not be preserved in the geologic record, other converging lines of evidence, such as those documented for the Alamo Event, must be used to recognize and correctly catalogue ancient marine impacts. Evidence compiled for the Alamo Impact documents the great magnitude and wide extent of the Event within onshore, offshore, and distal settings. Resulting breccias are now recognized at least 100 km from the inferred impact site, and distal quartz ejecta, as distant as 250 km. We interpret offshore deposits of the Alamo Breccia to be large, submarine mass-flow channels or sheets that were emplaced both by highenergy, outward- and downslope-directed surge currents/ tsunami originating at the Alamo Impact site and by inward-directed return currents backfilling the unstable transient crater. The complex internal stratigraphy of both onshore and offshore Breccia indicates that post-impact platform collapse, submarine mass-flow, and resulting megatsunami may have played an important role in modifying the initial Event deposits. On the basis of the multiple lines of evidence now recorded, we conclude that the Alamo Event resulted from a relatively large (~5-km-diameter) cometary impact into a deep-water, oceanic target west of the early Late Devonian carbonate platform.

Author

Breccia; Craters; Ejecta

20030067113 New Mexico Univ., Albuquerque, NM, USA

Impact Hydrothermal Alteration of Terrestrial Basalts: Explaining the Rock Component of the Martian Soil

Nelson, M. J.; Newsom, H. E.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color illustrations

Contract(s)/Grant(s): NAG5-8804; NAG5-10143; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The large energy in terrestrial impacts can create hydrothermal systems and consequently produce hydrothermal alteration materials. In this study we consider the chemistry of impact and volcanic hydrothermal alteration under relatively low water/rock ratios in basaltic or a somewhat more evolved protolith. Our work on the Lonar and Mistastin craters suggests that Fe-rich clays, including Fe-rich saponite can be produced. We postulate that similar alteration materials are produced on Mars and could be a component of the martian soil or regolith, contrary to some earlier studies. The martian regolith is a globally homogenized product of various weathering processes. The soil [1] is thought to consist of a rock component, with lesser amounts of mobile elements (Ca, Na, and K) than a presumed protolith, and a salt or mobile element component enriched in sulfur and chlorine [2, 3]. In this study we consider the contributions of impacts and consequent hydrothermal processes to the rock component of the martian soil.

Author

Basalt; Mars Surface; Craters; Hydrothermal Systems

20030067118 Planetary Science Inst., Tucson, AZ, USA

Starting Conditions for Hydrothermal Systems Underneath Martian Craters: 3D Hydrocode Modeling

Pierazzo, E.; Artemieva, N. A.; Ivanov, B. A.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Mars is the most Earth-like of the other planets of the Solar System. With widespread evidence of both heat sources and water, Mars is the first place to look for any sign of present or past extraterrestrial life. The presence of sub-surface water and surface ice or liquid water reservoirs throughout the Martian history is rather evident and it has received further confirmation by the current Odyssey mission. On the Martian surface, impact cratering and volcanism have provided temporary heat sources throughout Mars geologic history. This alters locally the thermal evolution of a mixed ice-rock subsurface mixture, and could cause the onset of a hydrothermal circulation. The realization that hydrothermal systems are possible sites for the origin and early evolution of life on Earth has given rise to the hypothesis that hydrothermal systems may have had the same role on Mars. The ample evidence for hydrothermal circulation underneath terrestrial impact structures suggests that hydrothermal system could have formed underneath large Martian impact structures as well. Rough estimates of the heat generated in impact events, as initial conditions for the development of an impact-related hydrothermal system, have been based on scaling relations. Preliminary studies suggest that the melt sheets and target uplift are equally important heat sources for the development of a hydrothermal system, while the lifetime of a hydrothermal system depends on the cooling rate of the heat source, as well as the permeability of the host rocks. Numerical studies of the thermal evolution of the target during an impact event have been carried out for specific terrestrial cases using two-dimensional (2D) impact simulations. We present preliminary results of three-dimensional simulations of impacts on Mars aimed at constraining the initial conditions for modeling the onset and evolution of a hydrothermal system on the red planet. The simulations of the early stages of impact cratering allow us to determine the amount of shock melting and the pressure-temperature distribution in the target caused by various impacts on the Martian surface. The late stage of crater collapse are then necessary to determine the final thermal state of the target, including crater uplift, and the final distribution of the melt pool, heated target material and hot ejecta around the crater.

Author

Planetary Geology; Hydrothermal Systems; Planetary Structure; Three Dimensional Models; Mars Craters; Meteorite Craters

20030067123 Toronto Univ., Ontario, Canada

Numerical Modelling and Petrophysical Constraints on the Magnetic Signature of Impact Structures

Ugalde, H. A.; Artemieva, N.; Milkereit, B.; Third International Conference on Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains color illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

The magnetic anomalies over impact structures are analyzed, and constrained by paleomagnetic data and numerical modelling. The processes that lead to magnetic anomalies on impact structures are addressed.

Author

Magnetic Signatures; Meteorite Craters; Magnetization

20030067126 New Brunswick Univ., Fredericton, New Brunswick, Canada

Structural and Geochronologic Constraints on the Timing of the Charlevoix Impact, Quebec, Canada

Whitehead, J.; Kelley, S.; Sherlock, S. C.; Grieve, R. A. F.; Spray, J. G.; Trepmann, A.; Third International Conference on

Large Meteorite Impacts; 2003; 2 pp.; In English; See also 20030067008; Original contains black and white illustrations; Copyright; Avail: CASI; [C01](#), CD-ROM; [A01](#), Hardcopy; Available on CD-ROM as part of the entire parent document

Accurate determinations of the ages of impact structures are required if associations between impacts and extinction events are to be tested. In addition, the existence of multiple and potentially related impacts can only be inferred if accurate ages exist for the candidate impacts. Although the 54 km-diameter Charlevoix impact structure in Quebec, Canada (47 deg 32 min N, 70 deg 17 min W) is the 13th largest confirmed impact structure on Earth its age is poorly constrained. A potential association between an impact event and the Devonian Frasnian/Famennian extinction has been made, and Charlevoix is a natural candidate. However, the established Devonian K-Ar ages for Charlevoix are inconsistent with the outcrop pattern of the structure. Here we present the preliminary results of a new Ar-Ar dating study of impact melt rocks and pseudotachylytes from the structure.

Derived from text

Geochronology; Impact Melts; Meteorite Craters; Meteorite Collisions

20030067127 Institut de Physique du Globe, Paris, France

Large Meteorite Impact on Sediments: Where Does the Lime Go?

Agrinier, Pierre; Martinez, Isabelle; Third International Conference on Large Meteorite Impacts; 2003; 1 pp.; In English; See also 20030067008; Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Shock metamorphism induced by large meteorite impacts on Earth decomposes sediments (carbonates : CaCO_3 and sulfates : CaSO_4) into CaO , CO_2 and SO_2 . For the Chicxulub case at the K/T boundary, up to 816 Gigatons of CO_2 and up to 214 Gigatons of SO_2 were liberated into the atmosphere. Though numerous works have depicted the resulting environmental consequences of dispersing CO_2 , SO_2 , dust into the atmosphere (greenhouse warming, aerosol cooling, acid rains, ...), no study have yet described the fate of the corresponding formed CaO (up to 1040 Gtons). Using the lowest published numbers, the Chicxulub impact liberated at least 401 Gtons. Assuming that CaO can rapidly (within less than 1000 seconds) backreacts with CO_2 and SO_2 at moderate temperature (500 to 1000 K) to form secondary carbonates and sulfates, up to 50 % of the initially released CaO , CO_2 and SO_2 are backreacted. This CaO sink leave at least 200 Gt of unreacted CaO cooled in the impact-expanding cloud and deposited with impact dust over the Earth surface (5×10^{18} sq cm). It represents a mean contribution of 40 mg of CaO per square centimeter. Considering the reactivity of CaO (lime) and of its hydrated product (Ca(OH)_2 ; portlandite) at low temperature for a short period of time (days-month). This would produce harmful environmental effects (organic matter is destroyed, natural waters are strongly depleted in carbonates and metals and symptomatic isotopic (13)C- and (18)O-depleted carbonates. Neutralization by fast atmospheric CO_2 pumping and acid rains (H_2CO_3 , H_2SO_4) produced by the impact liberated- CO_2 and SO_2 would control the duration of this high pH effect on lands, while at the surface of the oceans, additional mixing with normal pH (8.2) deep seawater would further reduce the duration of this high pH effect. The high reactivity of lime would control the lifetime of the K/T meteorite impact atmospheric CO_2 and SO_2 perturbations to a very short time scale, probably much less than one year.

Author

Cretaceous-Tertiary Boundary; Meteorite Collisions; Environment Effects; Calcium Oxides; Atmospheric Composition; Atmospheric Chemistry

20030067577 NASA Marshall Space Flight Center, Huntsville, AL, USA

Planetary Defense: Options for Deflection of Near Earth Objects

Adams, R. B.; Statham, G.; Hopkins, R.; Chapman, J.; White, S.; Bonometti, J.; Alexander, R.; Fincher, S.; Polsgrove, T.; Kalkstein, M.; [2003]; 23 pp.; In English; 39th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 20-23 Jul. 2003, Huntsville, AL, USA; Original contains black and white illustrations

Report No.(s): AIAA Paper 2003-4694; No Copyright; Avail: CASI; [A03](#), Hardcopy

Several recent near-miss encounters with asteroids and comets have focused attention on the threat of a catastrophic impact with the Earth. This document reviews the historical impact record and current understanding of the number and location of Near Earth Objects (NEO's) to address their impact probability. Various ongoing projects intended to survey and catalog the NEO population are also reviewed. Details are then given of an MSFC-led study, intended to develop and assess various candidate systems for protection of the Earth against NEOs. An existing program, used to model the NEO threat, was extensively modified and is presented here. Details of various analytical tools, developed to evaluate the performance of proposed technologies for protection against the NEO threat, are also presented. Trajectory tools, developed to model the outbound path a vehicle would take to intercept or rendezvous with a target asteroid or comet, are described. Also, details are given of a tool that was created to model both the un-deflected inbound path of an NEO as well as the modified, post-deflection, path. The number of possible options available for protection against the NEO threat was too numerous for them to all be

addressed within the study; instead, a representative selection were modeled and evaluated. The major output from this work was a novel process by which the relative effectiveness of different threat mitigation concepts can be evaluated during future, more detailed, studies. In addition, several new or modified mathematical models were developed to analyze various proposed protection systems. A summary of the major lessons learned during this study is presented, as are recommendations for future work. It is hoped that this study will serve to raise the level attention about this very real threat and also demonstrate that successful defense is both possible and practicable, provided appropriate steps are taken.

Author

Deflection; Near Earth Objects; Mathematical Models; Earth (Planet)

92

SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20030066423 Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil

Catalog of Dynamic Spectra of Decimetric Solar Explosions recorded by the Brazilian Solar Spectroscope (BSS): 2001

Fernandes, Francisco Carlos; 2003; 131 pp.; In Portuguese

Report No.(s): INPE-9652-RPQ/738; Copyright; Avail: Other Sources

The contents include a summary and description of the solar spectroscopy with visualization and analysis of its data, decimetric solar observations for 2001, and a catalog of recorded solar explosions.

CASI

Astronomical Catalogs; Solar Spectra; Solar Spectrometers

20030066526 NASA Marshall Space Flight Center, Huntsville, AL, USA

The NRC Research Associateship Program has Greatly Enhanced the Solar Research at Marshall Space Flight Center During the Last Quarter Century

Gary, G. A.; [2003]; 6 pp.; In English; No Copyright; Avail: CASI; [A02](#), Hardcopy

Under the educational Resident Research Associateships (RRA) program, NASA Headquarters funds post-doctoral research scientists through a contract with the National Research Council (NRC). This short article reviews the important influence that the RRAs have had on solar research at NASA's Marshall Space Flight Center (MSFC). Through the RRA program the National Research Council under the National Academy of Sciences has provided the Marshall Space Flight Center's Solar Physics Group with 29 post-doctoral research associateships since 1975. This starting date corresponds with the increased research activity in solar physics at MSFC. A number of MSFC scientists had been working on and supporting NASA's Skylab Mission in operation from May 1973 until February 1974. This scientific effort included the development MSFC's X-ray telescope SO56 and the development of the USA first full-vector magnetograph. Numerous engineers and scientists at MSFC supported the development and operation of the cluster of solar telescopes on the Apollo Telescope Mount (ATM), a principal part of the Skylab orbiting workshop. With the enormous volume of new and exciting solar data of the solar corona, MSFC dedicated a group of scientists to analyze these data and develop new solar instruments and programs. With this new initiative, came the world-renowned solar prominence expert, Dr. Einar Tandberg-Hanssen, from the High Altitude Observatory in Boulder, Colorado and the support of the first two RRAs in support of solar physics research.

Author

Magnetic Signatures; X Ray Telescopes; Solar Instruments; Solar Corona; Solar Physics

20030066927 Alabama Univ., Huntsville, AL, USA

Ground-Level Solar Cosmic Ray Data from Solar Cycle 19

Shea, M. A.; [2003]; 22 pp.; In English

Contract(s)/Grant(s): NAG5-8011; NAG5-8014; No Copyright; Avail: CASI; [A03](#), Hardcopy

The purpose of this grant was to locate, catalog, and assemble, in standard computer format, ground-level solar cosmic ray data acquired by cosmic ray detectors for selected events in the 19th solar cycle. The events for which we initially proposed to obtain these data were for the events of 23 February 1956, 4 May 1960, 12 and 15 November 1960 and 18 and 20 July 1961. These were the largest events of the 19th solar cycle. However, a severe (more than 50%) reduction in the requested funding, required the work effort be limited to neutron monitor data for the 23 February 1956 event and the three major events in 1960.

Derived from text

Solar Cosmic Rays; Solar Cycles; Neutron Counters; Cosmic Rays

20030067587 Smithsonian Astrophysical Observatory, Cambridge, MA, USA

Laboratory Studies in UV and EUV Solar Physics

Parkinson, William; August 2003; 2 pp.; In English

Contract(s)/Grant(s): NAG5-9516; No Copyright; Avail: CASI; [A01](#), Hardcopy

The Ion Beam Experiment at the Center for Astrophysics is dedicated to the study of ion-electron collision processes of importance in solar physics. A paper describing our most recent measurement 'Absolute cross section for $\text{Si}(2+)(3s3p(\sup 3)\text{Rho}(\sup 0))$ yields $3s3p(\sup 1)\text{Rho}(\sup 0))$ electron-impact excitation' was published during the past year. Dr. Paul Janzen received his PhD. from the Harvard Physics Department on the basis of this and other work, such as the new electron cyclotron resonance (ECR) ion source. The ion source is producing stable beams with large currents for our present work on $\text{C}(2+)$, and it also produces stable beams with large currents of more highly charged systems, for future work on systems such as $\text{O}(4+)$. The past year has been focussed on our current program to measure absolute cross sections for Electron Impact Excitation (EIE) in $\text{C}(2+)$, one of the primary ions used for probing the solar transition region. $\text{C}(2+)$ beams produced by the ion source have been transported to the interaction region of the experiment, where the collisions are studied, and Visiting Scientist Dr. Adrian Daw is currently collecting data to measure the $\text{C}(2+)(2s2p(\sup 3)\text{Rho}(\sup 0))$ yields $2p(\sup 2)(\sup 3)\text{Rho}$ EIE cross section as a function of collision energy, under the guidance of Drs. John Kohl, Larry Gardner and Bill Parkinson. Also this year, modifications were made to the ECR ion source in order to produce greater currents of highly charged ions. Testing of the ion source was completed. Modifications were designed to extend the photon detection capabilities of the apparatus to shorter UV wavelengths, or EUV. Following the work on $\text{C}(2+)(2s2p(\sup 3)\text{Pho}(\sup 0))$ yields $2p(\sup 2)(\sup 3)\text{Rho}$, the extended UV detection capabilities will be used to measure the $\text{C}(2+)(2s(\sup 2)(\sup 1)\text{S})$ yields $2s2p(\sup 1)\text{Rho}(\sup 0))$ EIE cross section. The EUV modifications complement those of the new ion source, by enabling detection of EUV light generated by high charge state ions and putting us in a position to measure the excitation cross sections for more highly charged ions as well.

Author

Solar Physics; Ultraviolet Radiation; Extreme Ultraviolet Radiation; Ion Beams; Atomic Excitations; Cross Sections; Electron Impact

93

SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *51 Life Sciences*; on human beings see *52 Aerospace Medicine*. For theory see *73 Nuclear Physics*.

20030067157 Lawrence Livermore National Lab., Livermore, CA

Development of a Detector to Measure the Angular Dependence of the Cosmic Ray Induced Neutron Background Flux at Ground Level

Morgan, J. F.; Gosnell, T. B.; Luke, S. J.; Archer, D.; Lochner, R. T.; Jan. 28, 2002; 10 pp.; In English

Report No.(s): DE2003-15003244; UCRL-ID-146964; No Copyright; Avail: Department of Energy Information Bridge

No abstract available

NTIS

Cosmic Rays; Flux (Rate)

99

GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

20030066239 NASA Ames Research Center, Moffett Field, CA, USA

Using the Human Eye to Characterize Displays

Gille, Jennifer; Larimer, James; [2001]; 16 pp.; In English; Electronic Imaging 2001, 2001

Contract(s)/Grant(s): 505-64-70; No Copyright; Avail: CASI; [A03](#), Hardcopy

Monitor characterization has taken on new importance for non-professional users, who are not usually equipped to make photometric measurements. Our purpose was to examine some of the visual judgments used in characterization schemes that have been proposed for web users. We studied adjusting brightness to set the black level, banding effects due to digitization,

and gamma estimation in the light and in the dark, and a color-matching task in the light, on a desktop CRT and a laptop LCD. Observers demonstrated the sensitivity of the visual system for comparative judgments in black-level adjustment, banding visibility, and gamma estimation. The results of the color-matching task were ambiguous. In the brightness adjustment task, the action of the adjustment was not as presumed; however, perceptual judgments were as expected under the actual conditions. When the gamma estimates of observers were compared to photometric measurements, problems with the definition of gamma were identified. Information about absolute light levels that would be important for characterizing a display, given the shortcomings of gamma in measuring apparent contrast, are not measurable by eye alone. The LCD was not studied as extensively as the CRT because of viewing-angle problems, and its transfer function did not follow a power law, rendering gamma estimation meaningless.

Author

Display Devices; Computers; Visual Discrimination

20030067480 NASA, Washington, DC, USA

American X-Vehicles: An Inventory X-1 to X-50 Centennial of Flight Edition

Jenkins, Dennis R.; Landis, Tony; Miller, Jay; June 2003; 64 pp.; In English; Original contains black and white illustrations Report No.(s): NASA/SP-2003-4531; NAS 1.21:4531; LC-2003-051364; No Copyright; Avail: CASI; [A04](#), Hardcopy

For a while, it seemed the series of experimental aircraft sponsored by the U. S. government had run its course. Between the late 1940s and the late 1970s, almost thirty designations had been allocated to aircraft meant to explore new flight regimes or untried technologies. Then, largely, it ended. But there was a resurgence in the mid- to late- 1990s, and as we enter the fourth year of the new millennia, the designations are up to x-50. Many have a misconception that X-vehicles have always explored the high-speed and high-altitude flight regimes - something popularized by Chuck Yeager in the original X-1 and the exploits of the twelve men that flew the X-15. Although these flight regimes have always been in the spotlight, many others have been explored by X-vehicles. The little Bensen X-25 never exceeded 85 mph, and others were limited to speeds of several hundred mph. There has been some criticism that the use of X designations has been corrupted somewhat by including what are essentially prototypes of future operational aircraft, especially the two JSF demonstrators. But this is not new-the X-11 and X-12 from the 1950s were going to be prototypes of the Atlas intercontinental ballistic missile, and the still-born Lockheed X-27 was always intended as a prototype of a production aircraft. So although this practice does not represent the best use of 'X' designations, it is not without precedent.

Author

Research Aircraft; Histories

Subject Term Index

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